



Apple Service
Technical Procedures
Volume Six

TECHNICAL PROCEDURES VOLUME SIX

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Apple Technical Procedures

Volume Six

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Macintosh and Macintosh Plus

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Macintosh and Macintosh Plus

Section 1 – Basics

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□ SAFETY PRECAUTIONS

The built-in video monitor of the Macintosh or Macintosh Plus is harmless as long as you're just watching the display. Removing the cover, however, exposes you to the high-voltage Cathode-Ray Tube (CRT)—the picture tube. The following precautions must be taken to ensure your safety, especially when you are making adjustments on a live monitor.

Safe Electrical Setup

- **Be sure your outlet is properly grounded and wired correctly.**

Polarity and ground testers are available from most electronics stores. Test all outlets in your service shop before working on **any** electrical equipment. If you have any doubts about your building's wiring, consult a qualified electrician.

- **Never use an adaptor plug to connect a monitor's three-prong power plug to a two-prong wall outlet.**

Adaptors defeat the ground pin, which is a safety feature.

- **Use an isolation transformer between the monitor and the outlet when performing live adjustments.**

Order an isolation transformer from your electronics distributor, and make it a practice to use it whenever you are working with **any** charged monitor or other powered system under test. An isolation transformer isolates the circuitry of the system under test from the power company's circuitry, thus reducing the likelihood of a fatal shock should you simultaneously contact high voltage and anything else that is earth-grounded.

Do not connect more equipment to the transformer than the wattage capacity of the transformer will bear. (It is usually best to connect only one piece of equipment at a time.) We recommend an isolation transformer with a minimum wattage capacity of 500 VA, with grounded three-prong cord and receptacle. Two such transformers, available from many electronics stores and distributors, are listed below:

Triad N-57M

Stancor GIS 500

CRT Safety Rules

- **Do not work on a monitor alone.**

If there is an accident, it could save your life to have someone else nearby. We recommend that your staff be trained in cardio-pulmonary resuscitation (CPR).

- **Remove rings, watches, bracelets, necklaces, and other jewelry before performing repairs on a CRT.**

Metal jewelry is an excellent conductor of electricity. Removing it reduces the possibility of electric shock.

- **Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments.**

Grounding wriststraps, heelstraps, and mats are used to protect sensitive components from the damaging effects of electrostatic discharge from your own body or clothing. Even though they contain a one-megohm resistor and are designed to conduct only small electrical charges, we recommend that they be used **only** when working on "dead" (uncharged) equipment.

- **Wear safety goggles when working with a CRT.**

The CRT contains a high vacuum. If cracked or broken, it can implode (collapse into itself), then explode. To protect your eyes from serious injury, always wear safety goggles when working on or near a CRT, and be careful of other people in the area.

- **Before working inside a monitor, turn off the power and disconnect the AC power cord.**

Certain parts of a monitor chassis are **hot** (electrified) when the monitor is under power. Except when you **must** have the power on (for example, when making live adjustments), never work on a plugged-in monitor—even if you have the power turned off.

- **Keep one hand in your pocket or behind your back when working on a live monitor.**

This reduces the risk of current passing through your heart, should you accidentally contact high voltage.

- **Always discharge the anode before touching anything inside the monitor.**

High voltage (approx. 12,000 volts DC) can be present on the anode (Figure 1, #2) and other components—even when power is off. Discharging the anode reduces the risk of injury.

- **Never touch the anode connector or the anode aperture.**

Normally the anode aperture (Figure 1, #2) has a connector plugged into it (Figure 1, #1). When a CRT is replaced, the anode connector is removed, exposing the anode. The anode can retain a charge of several thousand volts (even when power is off), and can regain some charge even after it has been discharged.

- **Do not pick up or handle a CRT by its neck.**

To prevent an implosion, you should take every precaution against breaking the tube. Be especially careful with the neck (Figure 1, #3), the area where the tube is the thinnest.

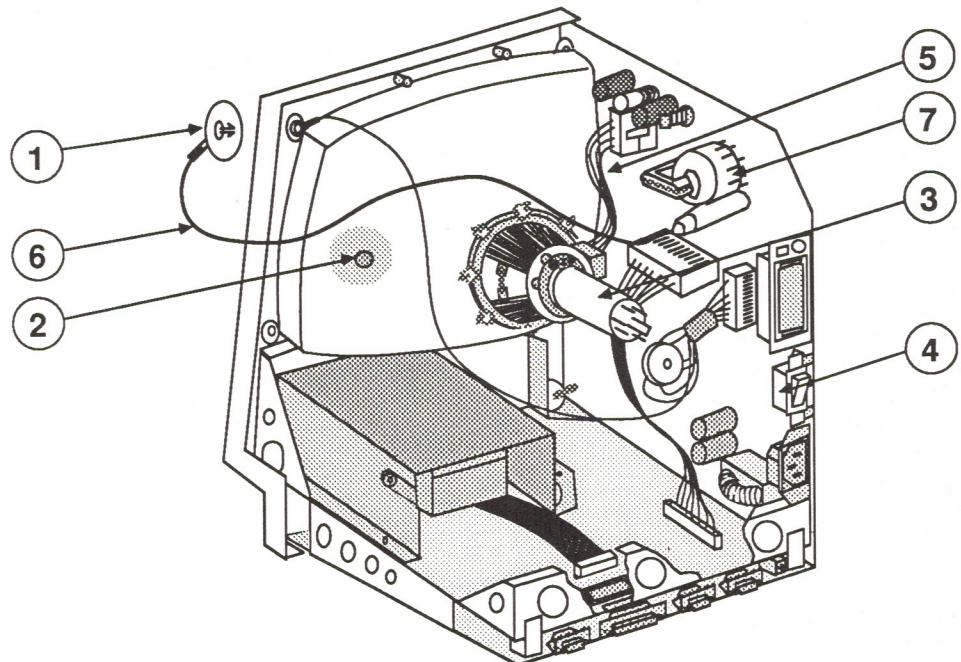


FIGURE 1

Live Adjustment Rules

In addition to the precautions listed on the previous pages, never touch the following components when adjusting a live Macintosh CRT:

- The back of the power switch (Figure 1, #4)
- The yoke wires (Figure 1, #5)
- The anode connector (Figure 1, #1)
- The anode wire (Figure 1, #6)
- The flyback transformer (Figure 1, #7)

❑ DISPOSING OF THE CATHODE-RAY TUBE (CRT)

Remember that a CRT can implode unless it is devacuumed. Putting a defunct CRT into a trash receptacle without devacuuming it can endanger other people.

Materials Required

Thick cardboard box, large enough to conceal the CRT
Large, sharp, diagonal cutters
Large pliers
Duct tape
Safety goggles
Gardening gloves
12-inch square of cloth or heavy paper

Devacuuming the CRT

1. Put on safety goggles.
2. In the side of the box about six inches from the bottom, cut or drill a hole just large enough to accommodate the very tip of the CRT neck.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape the box flaps down with the duct tape (Figure 2).

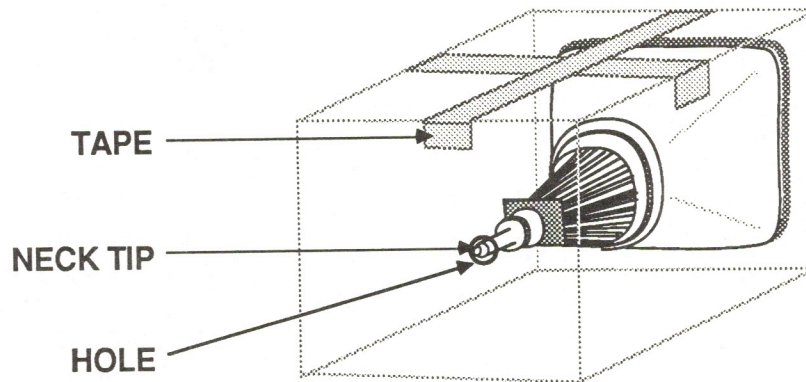


FIGURE 2

WARNING: Only the very tip of the CRT neck should be protruding through the hole in the box. The box must not have any other openings.

4. Put on the gloves.
5. If there is a plastic guide on the end of the CRT neck, pull it off. Using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
6. Tape the piece of cloth or paper onto the box (Figure 3, #1) so that it forms a veil over the opening (Figure 3, #2) but allows your hand access to the tip of the CRT. The veil's purpose is to catch bits of glass that may fly during the following step.

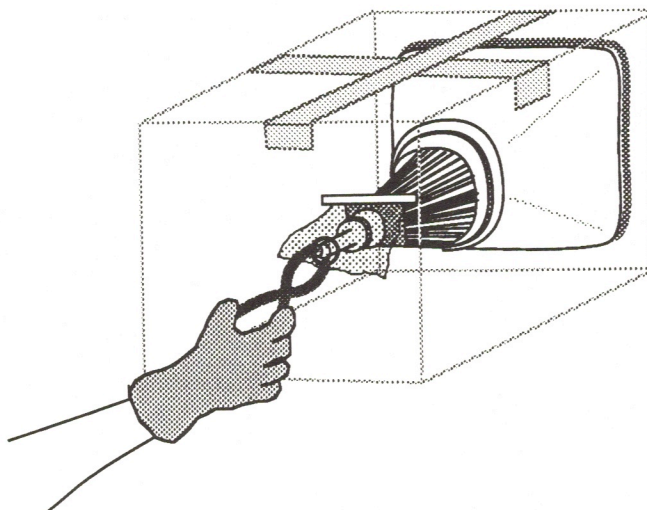


FIGURE 3

7. Make sure no one is standing nearby. Place the pliers under the veil, stand to one side, and look away while you use the pliers to snip off the exposed tip of the CRT.

WARNING: Do not look directly at the box when cutting off the tip of the CRT!

Note: You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the interior of the CRT is clearly visible through the opening created by the removed tip.

□ KEYBOARD AND KEYSWITCH IDENTIFICATION

The Macintosh keyboard without the numeric keypad uses Alps keyswitches (Figure 2). The locking keyswitch is used for the Caps Lock key, the other keyswitch for all other keys on the keyboard.

The Macintosh Plus keyboard with the numeric keypad uses two versions of keyswitches, Alps and Mitsumi. The keyswitches are not interchangeable between boards. They can be identified by referring to Figure 2 below.

The procedure to replace a keyswitch is in Section 3 of "You Oughta Know."

Note: Macintosh foreign language keyboards use the same type of keyswitches as the U.S. Macintosh.

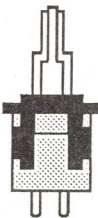


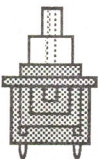
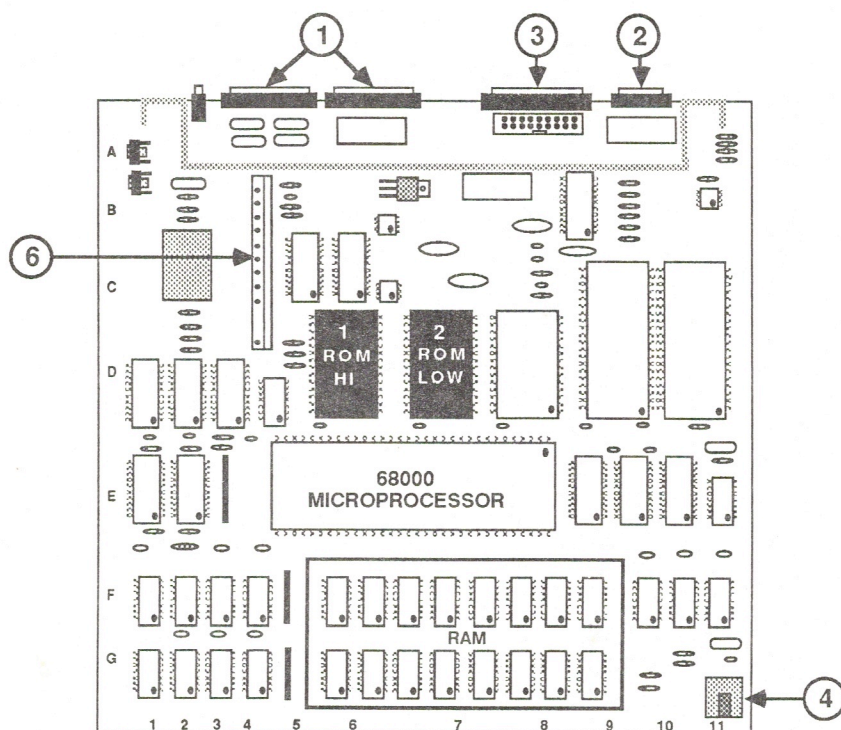
KEYSWITCH		KEYBOARD
	705-0070 ALPS LONG STEM ("Extended")	661-96154 661-0322
	705-0077 ALPS ALPHA LOCK ("Alternate Action")	
	705-0104 MITSUMI KEYSWITCH	661-0362
	705-0044 MITSUMI ALPHA LOCK KEYSWITCH	

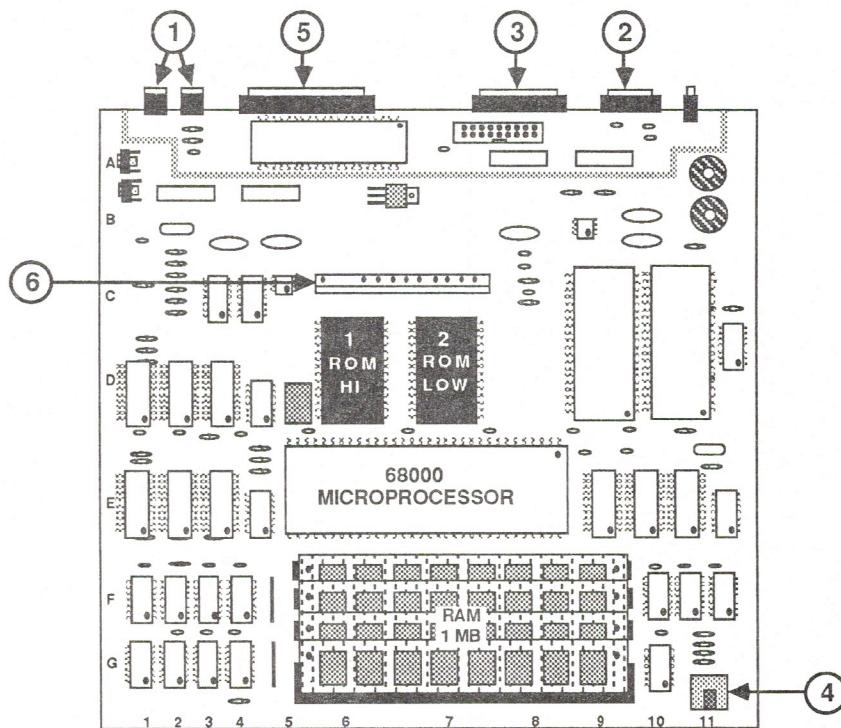
FIGURE 2: MACINTOSH KEYBOARD

□ MACINTOSH AND MACINTOSH PLUS – DIFFERENCES



MACINTOSH 128K/512K LOGIC BOARD

FIGURE 3



MACINTOSH PLUS 1 MEGABYTE LOGIC BOARD

FIGURE 4

Memory

Macintosh

128K or 512K bytes RAM
64K bytes ROM

Macintosh Plus

1 Mb RAM
128K ROM
256 bytes of
user-selectable
parameter memory

Disk Capacity

Macintosh

400K bytes per diskette
single-sided

Macintosh Plus

800K bytes per
diskette
double-sided

Keyboard

Macintosh

58 key, software mapped

Macintosh Plus

78 key, software
mapped, with
built-in numeric
keypad and
direction keys

Interfaces

The numbers at the left of the list below correspond to the locations on both Figure 3 (Macintosh) and Figure 4 (Macintosh Plus) unless otherwise noted.

- #1 Two RS232/RS422 Serial Ports
Macintosh uses DB-9 connectors
Macintosh Plus uses 8 Pin DIN connectors
- #2 Mouse Interface
- #3 External Disk Interface
- #4 Synchronous serial keyboard bus

Macintosh Plus only (Figure 4)

- #5 Small Computer Standard Interface (SCSI) Port:
an industry-standard interface that provides
extremely high-speed access to hard disks, tape
backup systems, and other mass storage devices.

Internal Connections

The connector that runs from the Power/Sweep Board to the Logic Board has been moved for the Macintosh Plus, as shown in Figures 3 and 4, #6.

□ THEORY OF OPERATION OVERVIEW

Introduction

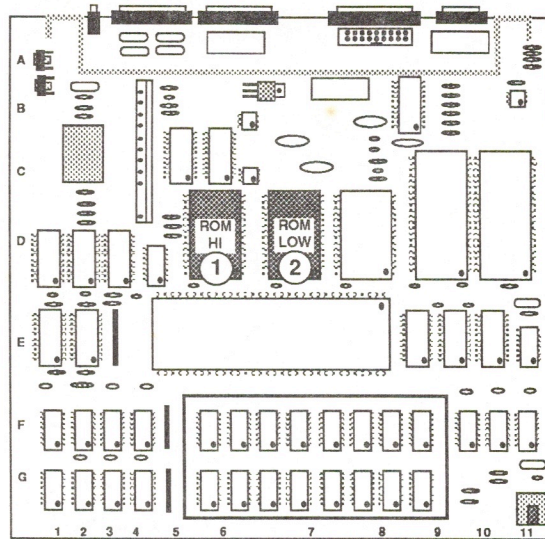
Troubleshooting can be approached in many different ways. Apple recommends two methods in particular: logical troubleshooting, and module swapping in a particular order for a particular symptom. Most troubleshooting charts in *Apple Technical Procedures* manuals are based upon the module-swapping method, but you can often save repair time by using logical troubleshooting before you start swapping.

Logical troubleshooting involves knowing the function of each module in the machine, and using that knowledge to narrow down your search for the problem. This section will give you the information necessary to perform logical troubleshooting of the Macintosh and Macintosh Plus. The information here includes a description of each module in the Macintosh and Macintosh Plus and the various functions it performs. (For definitions of basic terms, refer to "Simplified Overview of a Microcomputer System" under the tab *You Oughta Know....*)

Unless otherwise noted, all information included here is the same for the Macintosh and Macintosh Plus.

Modules and Functions

Logic Board



The Macintosh Logic Board shown above is the heart of the system. It contains the components described below. A number after an IC in the descriptions that follow corresponds to a number in the figure to the left (indicating its general location on the logic board).

The CPU, or 68000 microprocessor, gets instructions from memory, translates them, and carries them out. It communicates with all components on the Logic Board.

The RAM, or storage capability, varies. The Macintosh can have 128K or 512K. The Macintosh Plus has 1 megabyte of RAM installed on SIMM modules, which are mounted on the Logic Board.

The ROMs (1 is HI, 2 is LO) contain the operating code for the 68000. The Macintosh ROMs and the Macintosh Plus ROMs are different. Refer to Section 6, Additional Procedures, for specifics.

The IWM, or Integrated Woz Machine (named after Steve Wozniak), is a self-contained disk controller card on one IC. This IC supports both the internal and external disk drives.

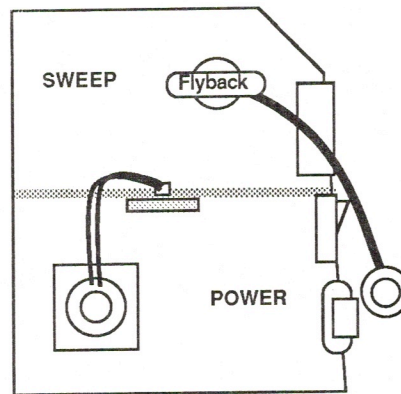
The SCC, or Serial Communications Controller, handles the information received and sent from the two serial ports on the rear of the machine. The Macintosh has two nine-pin serial ports. The Macintosh Plus has two eight-pin DIN connectors.

The VIA, or Versatile Interface Adapter, is a dual-port parallel interface. This IC converts serial data (from input devices) to parallel data, so that the logic board can interpret the information correctly. It provides an interface for the mouse and the keyboard.

The PALs, or Programmable Array Logic (customized ICs), replace from five to ten ICs. They perform various control and synchronizing functions for the rest of the Logic Board.

The Oscillator (timing device), generates the master clock pulse. The master clock pulse is broken down into various timing clocks needed by the ICs on the Logic Board.

Power/Sweep Board



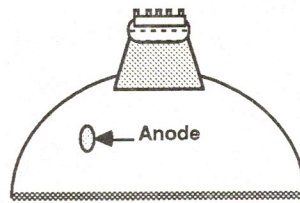
The Power/Sweep Board is divided into two sections, described below.

The speaker and the battery compartment are located on the power/sweep board. However, all the signals that operate these components are generated on the Logic Board; the power/sweep board does not use either of these items.

The power supply section is located on the bottom half of the board. This is where the AC voltage is converted to DC voltage for use by the entire system.

The sweep section is located on the upper half of the board. There are circuits for both the horizontal and the vertical signals that are fed to the CRT. The flyback transformer is part of the sweep section and delivers high voltage directly to the CRT through the anode connector.

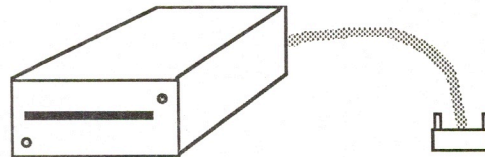
CRT



The CRT (Cathode Ray Tube) provides the high resolution video display. The power/sweep board connects to the anode to apply high voltage to the CRT.

The power/sweep board connects to the neck and to the yoke to supply various voltages and signals to the CRT to create the video display.

Disk Drives

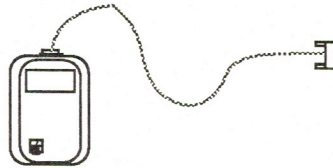


The internal disk drive connects to the main logic board through an internally installed connector. The external drive connects to the port on the back of the logic board.

Reading and writing operations are controlled by the Integrated Woz Machine on the logic board. The data passes through this IC on its way from the logic board to the diskette in the drive, or from the disk drive to the logic board.

The Macintosh has 400K disk drives. The Macintosh Plus has 800K disk drives. The 400K diskettes work on the 800K drives. The 800K diskettes do *not* work on the 400K drives.

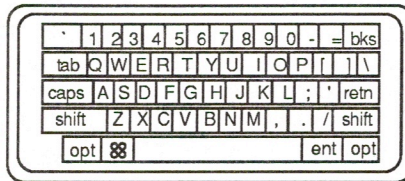
Mouse



The mouse connects to a nine-pin connector on the main logic board. The mouse is used to position the cursor on the screen.

The assemblies inside the mouse send a series of pulses to the Serial Communications Controller and the Versatile Interface Adapter. These ICs interpret and translate the information so that the logic board can utilize it.

Keyboard



The keyboard connects to the logic board through a four-wire coil with a telephone-type connector. The keyboard has its own microprocessor, which is used to implement a serial bus for communicating with the logic board.

The keyboard data is sent in serial form to the Versatile Interface Adapter, where it is converted into parallel data and translated so that the logic board can use it.

Macintosh and Macintosh Plus

Section 2 – Take-Apart

□ CONTENTS

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2.5	Cover
2.5	Remove
2.7	Discharge the Anode
2.7	Replace
2.9	Power/Sweep Board
2.13	Logic Board
2.15	CRT
2.16	Internal Disk Drive
2.17	Keyboard

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in that section.

Note: In the Macintosh spares kit is a useful videotape that demonstrates a complete take-apart of a Macintosh (the Macintosh Plus is not covered). The videotape, entitled *Servicing Macintosh*, shows the procedures in a somewhat different order from that given in these written procedures.

□ ESD PREVENTION

Introduction

ESD (Electrostatic Discharge) can cause severe damage to sensitive microcircuits. Just touching a chip or brushing it with a nylon sleeve can degrade a circuit so that it never performs again to specifications. Some microcircuits are sensitive to as little as 500 volts, or about one-sixth as much static electricity as you can feel.

The Macintosh and the Macintosh Plus contain C-MOS components, and the Macintosh Plus RAM memory is installed on four small separate boards called SIMM modules. Both the C-MOS and the SIMM modules are very susceptible to ESD damage.

Follow the instructions below to prevent ESD damage to the Macintosh or the Macintosh Plus components.

WARNING: *Discharge the Macintosh CRT before following these instructions. Never perform live monitor adjustments or discharge the Macintosh CRT while wearing a grounding wriststrap or working on a grounded workbench mat. Read the safety precautions in Section 1, Basics, before working inside the Macintosh.*

- 1. Before handling boards or ROMs, ground yourself!**
Wear a grounding wriststrap and attach it to your workbench pad. The pad must then be grounded to a workbench that is grounded to the building's ground.
- 2. Ground the Macintosh chassis to the same potential you hold.** Place the discharged Macintosh/Macintosh Plus on the grounded workbench pad. Be sure the chassis is in contact with the workbench pad at all times **or** connect the chassis to the workbench pad with alligator clips.
- 3. Use antistatic bags for carrying boards and ROMs.**
Whenever the ROMs or board are to be stored or moved anywhere, first put them in an antistatic bag. Be sure to touch the bags before touching the ROMs.

4. **Handle ROMs by the body, not the leads.** You may safely touch the leads only if you are grounded.
5. **Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the area.** The static field around these items cannot be removed.
6. **Do not place board or ROMs on any metal surface.** Place them on the grounded workbench pad or an antistatic or nonconductive foam.

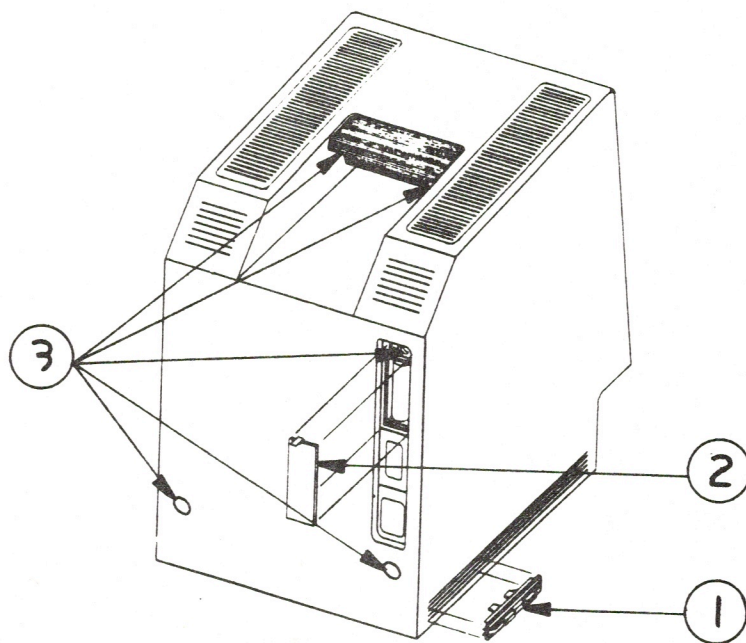


FIGURE 1

□ COVER

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

WARNING: *Macintosh and Macintosh Plus computers contain high voltage and a high vacuum picture tube. To prevent serious personal injury and property damage, make sure you read and understand the safety precautions in Section 1, Basics, before you remove the back cover. Failure to follow the safety rules could result in serious injury.*

Remove

1. Turn the power off and disconnect the AC power cord from the source and from the back of the computer.
2. Disconnect the mouse and all other external cables from the back of the computer. Disconnect the keyboard.
3. Remove the reset/interrupt switch (if installed) by prying it off with a small flatblade screwdriver (Figure 1, #1).
4. Press down the tab at the top of the battery compartment cover (Figure 1, #2) and pull it toward you.
5. Carefully place the computer face down on a soft cloth or foam pad (to prevent scratching the bezel).
6. Use a Torx screwdriver to remove the five screws (Figure 1, #3).
7. Use the pull-apart tool to gently pry the cover loose. Carefully lift up the cover (there is a fragile picture tube inside), and set it out of the way.

WARNING: *Remove your grounding wriststrap before continuing with the procedure for discharging the anode on the next page.*

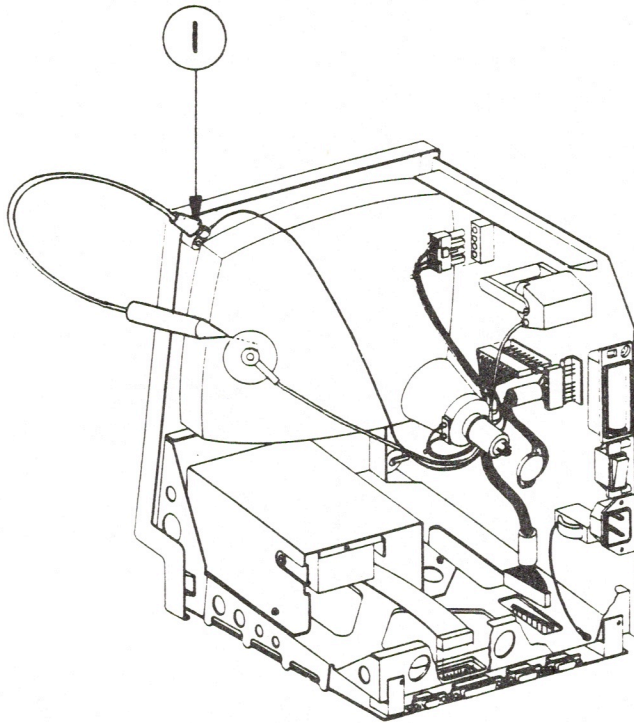


FIGURE 2

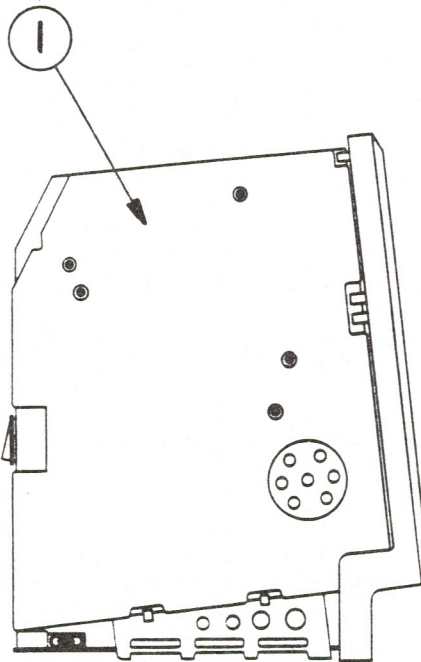


FIGURE 3

Discharge the Anode

In the following steps, you will discharge the high voltage (12,000 volts) from the picture tube. This lessens the chance of your receiving an electrical shock. Read through all the steps before performing the discharge procedure.

CAUTION: *Discharge the anode to the metal part of the ground lug displayed in Figure 2, #1. Failure to do so will damage the Logic and or Power/Sweep Board.*

1. Remove any jewelry (rings, bracelets, necklaces, watches, etc.) and set it aside. Put on safety goggles.
2. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (Figure 2, #1).
3. Put one hand in your pocket or behind your back and grasp the insulated handle of the screwdriver (don't touch the metal) with your other hand.
4. Hold the CRT discharge tool to the tube surface and insert it under the anode cap (Figure 2, #2) until it touches the anode ring.
5. Remove the CRT discharge tool from under the anode cap. To be sure the CRT is discharged, repeat step 4.
6. Remove the alligator clip from the ground lug. Set the tool aside where it will be out of the way.

Note: The anode can build up voltage over a period of time, so if repairs are not finished within 30 minutes, the anode should be discharged again.

Replace

1. Make sure that the insulating paper is in the proper position (Figure 3, #1) and that all cables are connected. Carefully slide the cover back onto the computer and check to see that it is properly seated.
2. Replace the five screws on the back of the computer.
3. Replace the battery compartment cover.
4. Replace the reset/interrupt switch if it was installed.

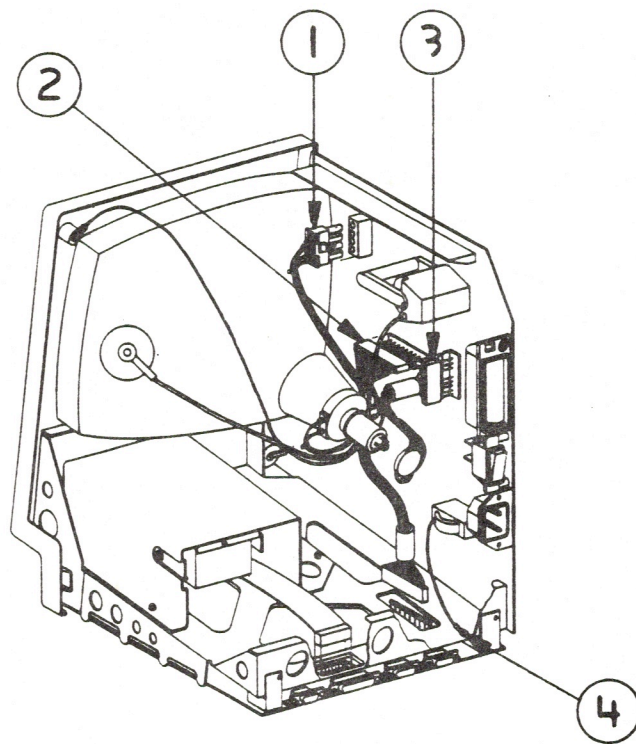


FIGURE 4

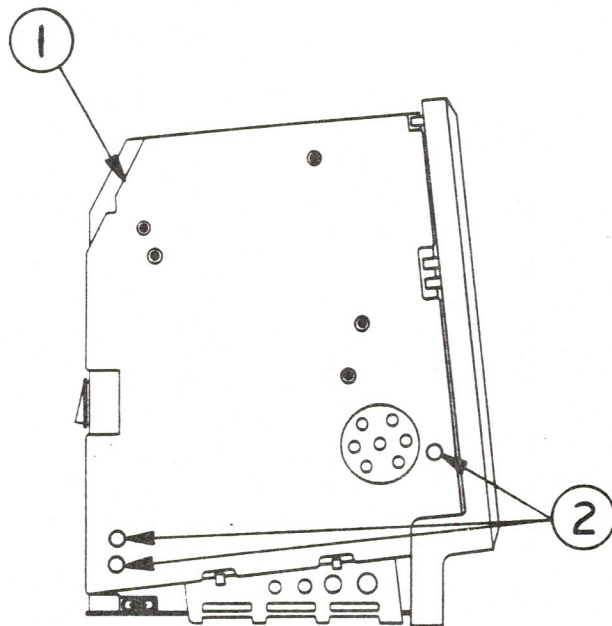


FIGURE 5

□ POWER/SWEEP BOARD

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

If a new power/sweep board is installed, perform the voltage adjustment as indicated in Section 5, Adjustments.

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: *Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.*

2. When the high voltage has been discharged from the anode, use your fingers to peel back the sides of the rubber anode cap. Notice the two prongs extending into the anode ring. Squeeze one prong against the edge of the anode ring to bring them together, then gently pivot them out of the anode ring.
3. Depress the tab on the yoke cable and unplug it (Figure 4, #1).
4. Remove the main logic cable from the power/sweep board (Figure 4, #2).
5. Remove the neck connector from the power/sweep board (Figure 4, #3).
6. Turn the computer upright and remove the screw, lockwasher, and ground wire at the bottom of the chassis (Figure 4, #4).
7. There are several versions of the insulating paper (Figure 5, #1). If there are no access holes for the three screws (Figure 5, #2), note how the paper is installed and then remove it.
8. Remove the three screws and washers (Figure 5, #2) holding the power/sweep board.
9. Lift up and pull out the power/sweep board.

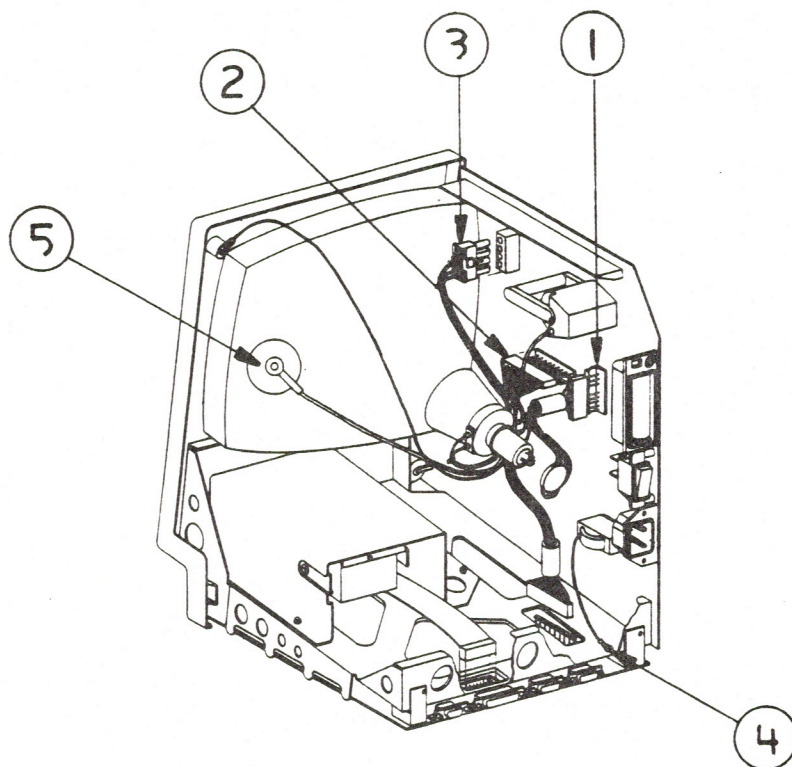


FIGURE 6

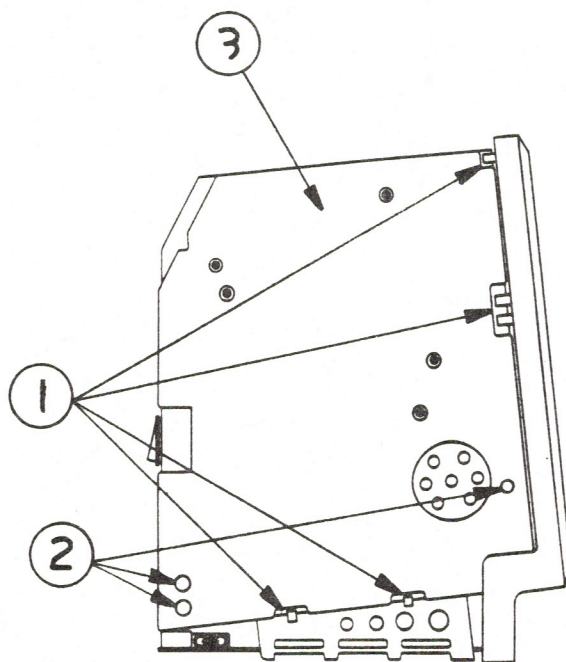


FIGURE 7

Replace

1. Turn the computer upright and position the power/sweep board at the right hand side of the chassis.
2. Connect the yoke cable (Figure 6, #1).
3. Connect the main logic cable (Figure 6, #2).
4. Slide the board into the slotted holders (Figure 7, #1) so that the three screw holes line up with the holes on the chassis (Figure 7, #2).
5. Connect the CRT socket cable to the power/sweep board (Figure 6, #3).
6. Replace the ground wire at the bottom of the chassis using a washer and Phillips head screw (Figure 6, #4).
7. Replace the three screws and washers (Figure 7, #2). If replacement screws are needed, refer to Section 6, Additional Procedures.
8. Replace the insulating paper if it has been removed (Figure 7, #3).
9. Connect the anode connector to the CRT (Figure 6, #5). Put one prong of the connector in at an angle and push it against the edge of the anode ring. Then insert the other prong.
10. Perform the voltage adjustment (refer to Section 5, Adjustments).
11. Replace the cover.

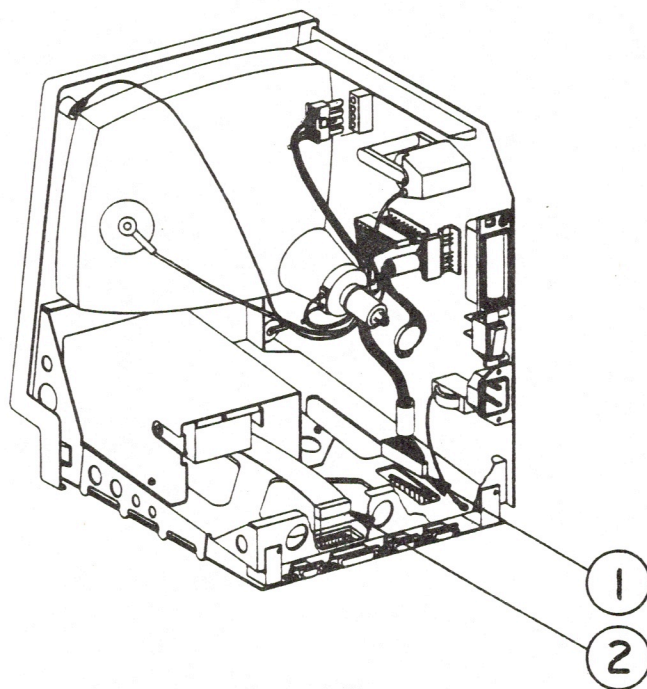


FIGURE 8

❑ LOGIC BOARD

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

If a new logic board is installed, perform the voltage adjustment as indicated in Section 5, Adjustments.

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: *Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.*

2. Remove the main logic cable from the main logic board (Figure 8, #1).
3. Remove the disk drive cable from the main logic board (Figure 8, #2).
4. Turn the computer face down and gently slide the main logic board up and out of the chassis.

Replace

1. Gently slide the main logic board into the chassis until it is firmly seated.
2. Replace the main logic cable (Figure 8, #1).
3. Plug in the disk drive cable (Figure 8, #2).
4. Perform the voltage adjustment (refer to Section 5, Adjustments).
5. Replace the cover (be sure the insulating paper is installed).

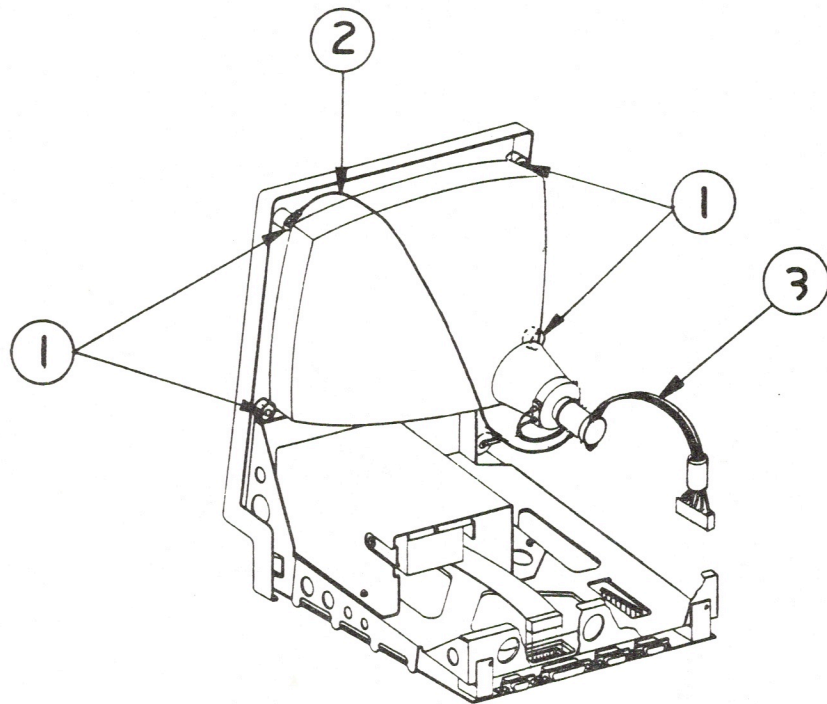


FIGURE 9

□ CRT

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.

2. Remove the power supply/sweep board.
3. Place the computer face down on a soft cloth or foam pad. Remove the four screws fastening the CRT (Figure 9, #1) and the ground wire (Figure 9, #2).
4. Gently remove the CRT socket cable (Figure 9, #3) by sliding it straight out from the neck.

WARNING: Handle the CRT by its sides only. Do not touch the anode.

5. Remove the CRT. A defective CRT should be placed in its original shipping container. A CRT should not be discarded unless it is devacuumed (refer to Section 1, Basics, for instructions).

Replace

1. Set the CRT in the case with the anode facing away from the power/sweep board (see Figure 9).
2. Connect the original CRT socket cable. A new CRT may have a small retainer on the neck pins. Remove it before replacing the CRT socket cable.
3. Replace the four CRT screws (Figure 9, #1). Be sure to reinstall the ground wire (Figure 9, #2).

□ INTERNAL DISK DRIVE

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: *Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.*

2. Remove the main logic board. Verify that the correct revision of ROM is installed. (refer to Section 6, Additional Procedures).
3. Turn the computer over and place it face down on a foam pad or soft cloth.
4. Locate the four Phillips screws that hold the disk drive and mounting bracket in position. Remove them from the chassis.
5. Slide the disk drive out of the chassis.

Replace

Read the "800K Diskette Ejection Problems" in Section 6, Additional Procedures, before replacing the disk drive.

Examine the chassis and determine whether the mounting holes for the screws are *round* or *oval*. Then perform the appropriate procedure below.

Round Mounting Holes

1. Slide the new drive into position.
2. Align the mounting screw holes and tighten the four screws.

Verify the placement of the disk drive by inserting a diskette into the disk drive and checking that the diskette slides in and out of the drive without rubbing against the case.

*Oval
Mounting Holes*

1. Slide the new drive into position.
2. Align the front of the drive with the plastic stops on the front of the bezel. Insert and tighten the four mounting screws.

Verify the placement of the disk drive by inserting a diskette into the disk drive and checking that the diskette slides in and out of the drive without rubbing against the case.

□ KEYBOARD

Exchanging the Keyboard

If you are exchanging the keyboard, **do not** remove the keyboard mechanism. Send the entire unit (**without** the cable) in for exchange. The procedure below is to be used for replacing keyswitches only.

Materials Required

Medium Phillips screwdriver

Remove

1. Disconnect the keyboard from the Macintosh or Macintosh Plus
2. Remove the six screws from the back of the keyboard. Remove the top plastic cover.
3. Lift the mechanical assembly out of the bottom case.
4. Use the replacement procedures for Macintosh keyswitches in *You Oughta Know*. To identify the keyswitches, refer to Section 1, Basics.

Replace

1. Set the mechanical assembly back into the bottom case.
2. Position the top plastic cover.
3. Hold the cover in place, turn the keyboard over, and install the six screws.

Macintosh and Macintosh Plus

Section 3 – Diagnostics

□ CONTENTS

3.2	Introduction
3.2	MacTest
3.2	How to Use It
3.3	Things to Remember
3.5	Backup Procedure
3.10	Running MacTest
3.11	Materials Required
3.12	Pull-down Menus and Icons
3.12	512K
3.12	Select Test
3.14	Options
3.15	Apple
3.16	Miscellaneous Icons
3.16	Running the Diagnostic
3.19	Error Codes

Note: Always use the most recent revision of *MacTest*. Refer to the *Apple Service Programs Manual* for the number of the latest revision.

□ INTRODUCTION

MacTest

This section describes general procedures for using the *MacTest* diagnostic diskette to test the Macintosh and Macintosh Plus logic board and disk drives. *MacTest* is a pass/fail diagnostic test, which indicates the area being tested and the kind of test being performed when a failure occurs.

How to Use It

The *MacTest* diskette is used to identify module failures of the main logic board, keyboard, keypad, and disk drives on the 128K and 512K Macintosh as well as the 1024K Macintosh Plus.

Before running *MacTest*, read the section entitled "Things To Remember."

If you cannot boot the diskette, check the power cable and internal cable connections. If all the cables are secure, turn to Section 3, Troubleshooting, and replace the module(s) specified for the problem you are experiencing. Attempt to boot the diskette after each module swap to check whether the problem has been solved.

Replace modules when indicated by test results. Verify that the problem has been corrected by retesting with the diagnostic diskette. If correct operation is still not obtained, turn to the Troubleshooting section and follow its instructions.

If you receive an error code while attempting to run *MacTest*, check the list at the end of this section for what you can do to correct the problem.

□ THINGS TO REMEMBER

Backup Information

1. Make a backup diskette before you begin! When testing a defective Macintosh or Macintosh Plus, it is possible to erase and/or damage a section of the *MacTest* diskette.

There are two copy routines included on the *MacTest* diskette. Be sure to follow the instructions included in this section under "Backup Procedure."

Loopback Information

2. Identify the machine as a Macintosh or a Macintosh Plus. Connect the correct loopbacks for the machine you are testing (see "Materials Required" for more information).
3. Whenever a dialog box appears indicating that an item is not connected or installed (**keyboard** or **loopbacks**, for example), click in the **OK** box. **The test sequence will be aborted and an error code will be displayed.** Connect the item and/or deselect the test from the **Select Test** menu, reboot, and run the diagnostic again.
4. If the loopback cable and/or the SCSI loopback test card are not connected, be sure to deselect **Serial Loopback** and/or **SCSI Loopback [Mac+]** under the **Select Test** menu, and save the new configuration.

If you do not deselect the tests, a dialog box will appear asking if the loopback cables are installed. Click in the **OK** box. **The test sequence will automatically abort.**

5. If the loopback cable and/or the SCSI loopback test card are installed, be sure to select **Serial Loopback** and/or **SCSI Loopback [Mac+]** under the **Select Test** menu, and save the new configuration. If you do not select the tests, the ports will not be tested.
6. If you are using the SCSI loopback test card it must be correctly installed or the Macintosh Plus will be "recognized" as a 512K Macintosh.

Powering Off

7. To eject the *MacTest* diskette, pull down the **Options** menu and select **Shutdown**.

Saving Configurations

8. Under **Options** is an item called **Save Configuration**. This option allows you to save a favorite configuration on the diskette. The name of the file **must** be **Options.OPTN** to run.

DeskTop Appears

9. If the *MacTest* window does not appear but a screen with desktop and file icons does appear, you will need to:

- a) Open the *MacTest* diskette icon, and highlight the **MacTest** file icon.
- b) Pull down the **Special** menu and select **Set Startup**.

The internal disk drive will whirl for a few seconds and stop.

- c) Reboot the *MacTest* diskette.

Stopping Continuous Test

10. To stop the continuous test, do the following (the mouse will respond slowly):

- a) Pull down the **Options** menu and select **Auto Run Not Selected**.
- b) Pull down the **Options** menu and select **Save Configuration**.

The new configuration will be saved. The continuous test will stop after the next reboot cycle.

Desk Accessories

11. All Desk Accessories must be closed before running *MacTest*.

External Drives

12. *MacTest* cannot test an external drive that is connected through a Hard Disk 20.

□ BACKUP PROCEDURE

Two copy programs are included on the *MacTest* diskette for your convenience. Both routines require two disk drives.

400K Drive Copy

The destination diskette for the *400K Drive Copy* must be a double-sided diskette, but it must be inserted into a 400K external disk drive.

800K Drive Copy

The *800K Drive Copy* program must be run on the Macintosh Plus with 1024K of memory. The program will allow you to format and copy to either double- or single-sided diskettes.

Procedure

1. Write protect the *MacTest* diskette.
2. Insert the *MacTest* diskette, and power on the system.

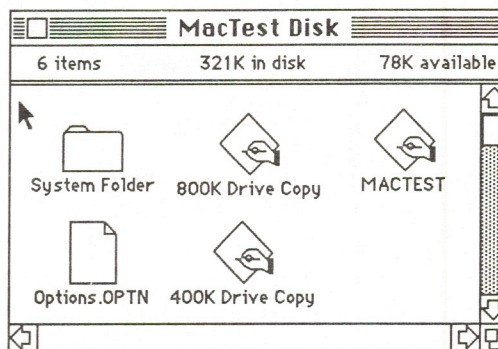
The **Service MacTest** window will appear.

3. Pull down the **Options** menu and select **Quit to Finder**.

The drive will whirl, and the desktop will appear with the *MacTest* diskette displayed in the upper right-hand corner.

4. Open the *MacTest* diskette icon.

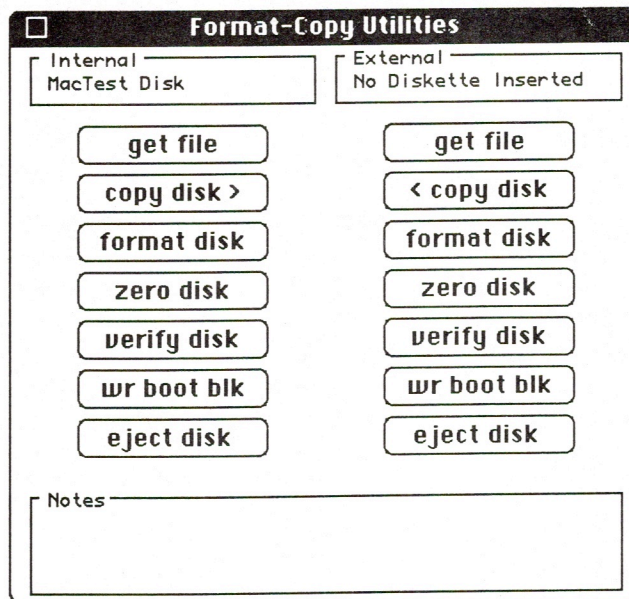
The following file icons should be displayed.



5. Open either the **400K Drive Copy** or the **800K Drive Copy** icon. Follow the appropriate instructions on the next few pages.

400K Drive Copy

1. The following window will appear.



The message under **Internal Disk** should be "MacTest."

Dialog Box Appears

2. Insert a blank or a diskette you wish to copy over (double-sided) into the external drive. If a dialog box appears asking "Do you want to initialize it?":
 - a) Click in the box labeled **Initialize**.
 - b) A dialog box will appear asking you to name the diskette. Enter a name and then click in the box labeled **OK**.
 - c) The copy window will again be displayed. The name of the diskette in the external drive will appear in the block labeled **External Drive**.
 - d) Continue to step 3.

...Continued on next page

No Dialog Box Appears

If the dialog box does not appear:

- a) The name of the diskette will appear in the block labeled **External Drive**.
 - b) Under the box labeled **External** is a column of boxes with various commands. Click in the box labeled **Format**. The external drive will whirl and the message "Disk Format In Progress" will appear in the box labeled **Notes**. On completion the message "Disk Format Was Successful" will appear in the box labeled **Notes**.
 - c) Continue to step 3.
3. Under the box labeled **Internal** is a column of boxes with various commands. Click on the box labeled **<Copy Disk>**.

The message "Disk Copy In Progress" will appear in the box labeled **Notes**. The drives will whirl for a few minutes. The external drive will eject the diskette on completion of the copy. The message "Disk Successfully Copied" will appear under the box labeled **Notes**.

4. You now have two choices:

If you wish to make additional copies:

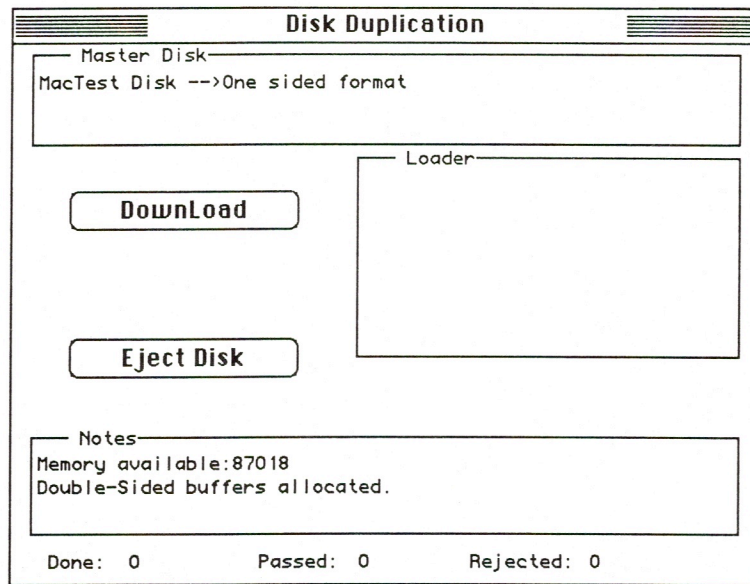
- a) Insert a blank or a diskette you wish to copy over into the external drive.
- b) Repeat steps 2 and 3.
- c) Repeat steps 4a and b until you have the number of copies you desire.

If you wish to quit making copies, pull down the **Utility** menu and select **Quit**. The desktop will appear.

You now have one or more copies of the *MacTest* diskette. Place the original in a safe place.

800K Drive Copy

1. The following window will appear.



Wait till the **Watch** icon disappears.

2. Click in the box labeled **DownLoad**.

The message "Disk Download in progress...." will appear in the box labeled **Notes**. The drive will whirl for approximately one minute, and then it will eject the *MacTest* diskette. The message "Disk Successfully Downloaded" will appear in the box labeled **Notes**.

3. Insert a blank or a diskette you wish to copy over (double-sided) into the external disk drive.
4. Click in the box labeled **Start**.

The message "Format/Copy in progress" will appear in the box labeled **Notes**. The drive will whirl, and the message will change to "Verify in progress." The message will change to "Disk Copy is successful" and the copy will be ejected from the external disk drive.

5. You now have two choices.

a) If you wish to make additional copies:

- 1) Insert a blank or a diskette you wish to copy over into the external drive.

The program will make another copy without any commands being entered.

- 2) Repeat this until you have the number of copies you desire.

b) If you wish to quit making copies.

- 1) Click in the box labeled **Stop**.
- 2) Pull down the **Options** menu and select **Quit**.
- 3) Insert the *MacTest* diskette, as instructed in the dialog box.

The desktop will return.

You now have a copy of the *MacTest* diskette. Place the original in a safe place.

❑ RUNNING *MACTEST*

Materials Required

Identify which Macintosh you have by examining the connectors on the rear of the machine (see Section 1, Basics). Locate the following equipment for the Macintosh **or** for the Macintosh Plus.

Note: The loopback equipment does not need to be installed to run the diagnostic. However, to test the machine completely the loopbacks should be used. Refer to "Things to Remember" at the beginning of this section.

Macintosh

MacTest diagnostic diskette
DB 9 Serial Port Plug (Set of 2)
Blank 400K formatted diskette for External Drive Test

The DB 9 loopback connectors should be installed on the two serial ports on the rear of the machine.

Macintosh Plus

MacTest diagnostic diskette
DIN-8 to DIN-8 Serial Port Cable (loopback connector)
SCSI Loopback Test Card
Blank formatted 400K diskette for External Drive Test

The loopback cable with DIN-8 connectors should be installed between the two serial ports on the rear of the machine.

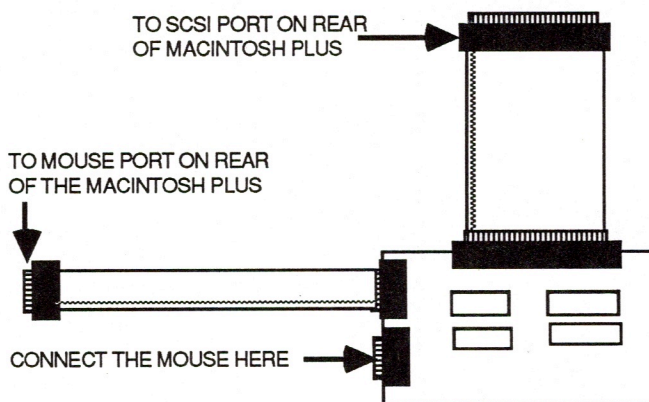


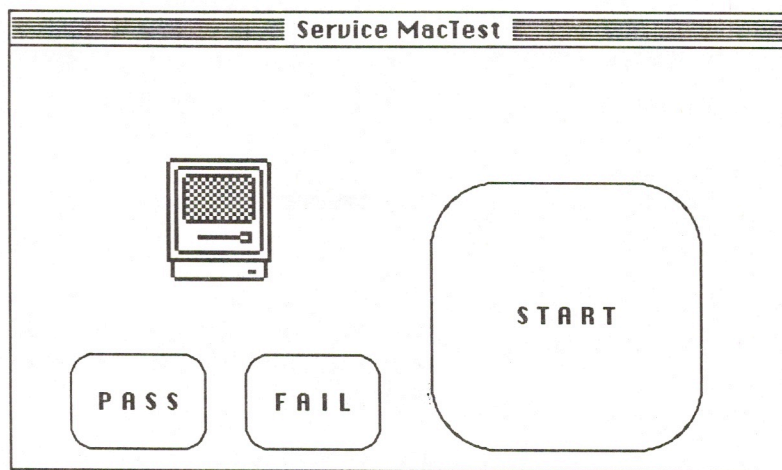
FIGURE 1

**Pull-Down
Menus and
Icons**

The SCSI Loopback Test Card should be connected to the Macintosh Plus (Figure 1). The cable connected to the SCSI port will need to be folded over in order to reach the port on the Macintosh Plus.

The new-style mouse with the small connector **must** be used. Gently jiggle the mouse connector onto the board at the location indicated below.

The following window should appear (on a 512K Macintosh).



The following pages will explain how to use and what to expect from each of the features listed under the four pull-down menus.

512K

512K

Memory Size

This pull-down menu indicates the amount of memory in the Macintosh or Macintosh Plus you are working on. For a 128K machine, **128K** would be displayed. For the Macintosh Plus, **1024K Mac+** would be displayed.

Select Test

Select Test

Video Alignment Screen
✓Main Logic I, except RAM Tests
✓Main Logic II, RAM Tests
✓Short RAM Tests, [3 Min per 512K]
Long RAM Tests, [6 min per 512K]
✓Serial LoopBack
✓SCSI LoopBack [Mac+ only]
✓Internal Disk Drive
External Disk Drive

The **Select Test** menu lists the various tests available to you.

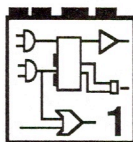
To select a test, pull down the menu and highlight the test you want, then release the mouse button. Pull down the menu again and notice the check mark that has appeared.

To deselect a test, pull down the menu and highlight the test you want, then release the mouse button. If you pull down the menu again, you will notice that the check mark is gone. The tests are described below.

Video Alignment
Screen

The **Video Alignment Screen** is a white screen, with twelve grayscale squares for focus. The screen may be used to properly align and focus the video display.

Main Logic I,
except RAM Tests



When selected, the **Main Logic I** verifies the working condition of various hardware items on the board.

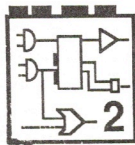
The loopbacks do not have to be installed to run this test. However, if they are not installed, the **Serial Loopback** and **SCSI Loopback [Mac+]** tests should be deselected.

If the loopback tests are selected but the loopbacks are not installed, a dialog box will appear asking if the loopback connectors are installed: click in the **OK** box. **The test sequences will automatically abort when you click in the OK box.** Then you can either deselect the tests for the ports, save the configuration, and rerun *MacTest*, or install the loopbacks and rerun *MacTest*.

If the loopback cables are installed and you want the ports tested, you will need to select one or both of the loopback tests and save the configuration.

The icon shown above is displayed in the **Service MacTest** window when this test is being performed.

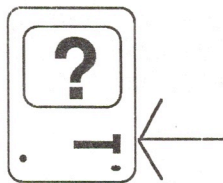
Main Logic II, RAM Tests



When selected, the **Main Logic II, RAM Tests** option verifies the RAM installed on the logic board. In order to test the RAM completely, you also need to select either the **Short RAM Tests [3 MIN per 512K]** or the **Long RAM Tests [6 Min per 512K]**. These selections will determine how long the RAM will be tested. When the RAM test is running, the menu bar at the top of the screen will flash slowly.

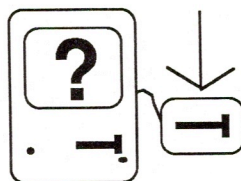
The icon above is displayed in the **Service MacTest** window when this test is being performed.

Internal Disk Drive



When selected, the **Internal Disk Drive** test verifies the functionality of the internal disk drive. The icon above is displayed in the **Service MacTest** window when this test is being performed.

External Disk Drive



When selected, the **External Disk Drive** test verifies the functionality of the external drive. Insert a blank formatted diskette into the external drive before testing. The icon above is displayed in the **Service MacTest** window when this test is being performed.

Options

Options
Show GoNoGo Window
Auto Run Selected
✓Auto Run Not Selected
Save Configuration
Quit to Finder
Shut Down

This **Options** menu lists the various features available when using the *MacTest* diskette. Check marks indicate options that are currently selected.

Auto Run Selected

Auto Run allows you to run the Logic I, Logic II (which must be selected) and Internal Disk Drive tests in a continuous loop. Appropriate loopback connectors must be installed to use the Automatic Run feature effectively. The External Disk Drive test may be selected, but it will run only once. Under Auto-Run *MacTest* will run automatically until a failure occurs. To stop the automatic test sequence, refer to Things to Remember.

Auto Run Not Selected

If **Auto Run Not Selected** is displayed, *MacTest* will run each selected test once and will then reboot and display the results with an icon.

Save Configuration

IMPORTANT: The diskette must be unlocked before you try to save a configuration. The program does not warn you when the disk is locked.

Save Configuration allows you to customize your *MacTest* diskette. Select the tests you want to run and select this feature. A window will appear with a file named **Options.OPTN** displayed. Click in the **Save** box.

The file you save must be named "Options.OPTN" to run.

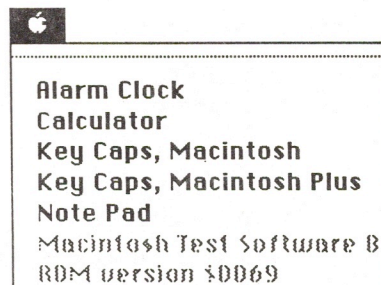
Quit to Finder

Quit to Finder returns you to the desktop with the disk and file icons displayed.

Shut Down

Shutdown ejects the diskette and reboots the system.

Apple



The Apple (🍏) menu allows you to test the keyboard, keypad, and speaker for the machine you are testing. Perform the logic board test before performing any of these tests.

IMPORTANT: All desk accessories must be closed before running *MacTest*.

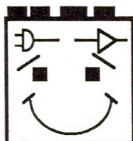
Calculator

When selected, **Calculator** displays a window with a calculator. Press each key on the keypad and verify that it is highlighted in the window. If a key is not highlighted, the keyswitch is bad and the numeric keypad (Macintosh) or the keyboard (Macintosh Plus) should be replaced.

Key Caps

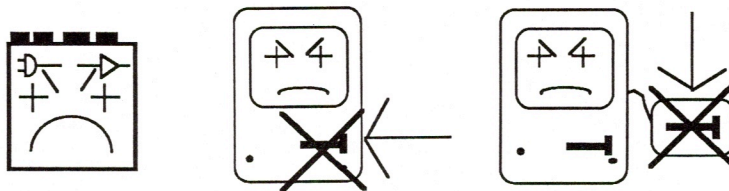
There are two **Key Caps** tests, one for the Macintosh and one for the Macintosh Plus. Choose the appropriate test. When selected, this feature displays a window with a keyboard. Press each key on the keyboard and verify that the display block for that key is highlighted. If the key is not highlighted, the keyswitch is bad and the keyswitch should be replaced. If numerous keys are not highlighted, exchange the keyboard.

Miscellaneous Icons



Pass

If all tests pass, the Macintosh/Macintosh Plus will reboot after a few minutes, momentarily highlight the **PASS** icon box, and display a "happy face" icon, similar to the one above.



Fail

If a test fails, a bad module will be indicated by a "sad face" icon of the specific module. If any test fails, the tests will stop running and the **FAIL** icon box will be highlighted. The icons are (above from left to right): the logic board, the internal disk drive, and the external disk drive.

Running the Diagnostic

The following are abbreviated procedures for running a standard test, a customized test, or a continuous test. The amount of time you need to run the diagnostic will range from two minutes to twenty minutes, depending on your machine and the tests you select.

If you need additional information, refer to "Things to Remember" and "Pull-Down Menus and Icons."

Standard

The *MacTest* diskette is shipped configured to run the Logic I test, the Logic II test, and the the Internal Drive tests.

1. Install the appropriate connectors for the machine you are testing.

2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear.

If a test fails, a "sad face" icon of the bad module will appear.

5. Pull down the **Apple** menu and perform the **Key Caps**, **Control Panel** (speaker), and **Calculator** tests, if applicable.

Customized

This test allows you to select the modules you want to test, be it one module or any combination of modules.

1. If the logic board is to be tested, install the appropriate loopback connectors for the machine you are testing.

2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Select the test(s) you want to run from the **Select Test** pull-down menu.

5. On completion, pull down the **Options** menu and select **Save Configuration**.

A dialog box will appear with the message "Save Test Data as: Options.OPTN."

Click in the **Save** box.

A dialog box will appear asking, "Replace existing Options.OPTN?"

Click in the **Yes** box.

The disk will whirl for a few seconds and the **Service MacTest** window will be displayed.

6. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear.

If a test fails, a "sad face" icon of the bad module will appear.

Continuous

This test allows you to run the Logic I test, the Logic II test, and the Internal Disk Drive test continuously or overnight to check for intermittent problems.

1. The appropriate loopbacks must be installed to use the continuous test feature effectively.
2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Verify that the tests listed above are selected in the **Select Test** pull-down menu.

If they are not selected, select them now.

5. On completion, pull down the **Options** menu and select **Auto Run Selected**.

6. Then pull down the **Options** menu and select **Save Configuration**.

A dialog box will appear with the message "Save Test Data as: Options.OPTN".

Click in the **Save** box.

A dialog box will appear asking "Replace existing Options.OPTN?"

Click in the **Yes** box.

The disk will whirl for a few seconds and the **Service MacTest** window will be displayed.

7. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear. The cycle will be repeated continuously until stopped.

If a test fails, a "sad face" icon of the bad module will appear and the testing will stop.

8. To stop the continuous test do the following:
 - a) Pull down the **Options** menu and select **Auto Test Not Selected**.
 - b) Pull down the **Options** menu and select **Save Configuration**.

The new configuration will be saved and the continuous test will stop after the next reboot cycle.

Error Codes

Error codes may appear when you run the *MacTest* diskette. The following chart lists the various error codes that may be displayed (the X's in the error code can be ignored) and the things you should check to correct the problems.

Before using the chart, verify that you are using a **known-good MacTest** diskette.

If an error code is displayed, find it in the list below and check the items listed to the right. After each step, run *MacTest* to see if the error code is still displayed.

Error Code

Things to Check

100XX.XXXX

1. Keyboard connected correctly?
2. Exchange keyboard cable.
3. Exchange keyboard.
4. Exchange logic board.

200XX.XXXX

1. Appropriate loopback connectors installed?
2. Dialog box appeared asking if cables were connected?
3. Loopback connectors work OK on another machine?
4. Exchange logic board.

300XX.XXXX

1. Check items listed for 200XX.
2. Exchange logic board.

400XX.XXXX

1. *MacTest* diskette unlocked?
2. Exchange internal disk drive.

500XX.XXXX

1. Blank formatted 400K diskette installed in external disk drive before running test?
2. Formatted diskette unlocked?
3. Exchange external disk drive.

600XX.XXXX

- Exchange Logic Board.

Macintosh Plus Error ONLY

800XX.XXXX

1. SCSI Loopback Test Card connected?
2. Dialog box appeared asking if cables were connected?
3. SCSI Loopback Test Card works OK on another machine?
4. Exchange logic board.

Macintosh and Macintosh Plus

Section 4 – Troubleshooting

□ CONTENTS

- 4.2 Introduction
 - 4.2 General Information
 - 4.2 Before You Start
 - 4.2 How to Use the Symptom Chart
 - 4.2 Exchanging the Logic Board
 - 4.2 Exchanging the Power/Sweep Board
- 4.3 Things to Remember
- 4.4 Symptom Chart
 - 4.4 Video Problems
 - 4.5 Drive Problems
 - 4.6 Peripheral Problems
 - 4.7 Miscellaneous Problems
 - 4.8 Special Problems

□ INTRODUCTION

General Information

Use this troubleshooting section if the diagnostics are unable to detect a module failure or if the diagnostic disk cannot be booted. After you repair the system, run the diagnostic test to verify system operation.

Before You Start

Read the section entitled "Things to Remember" before you begin troubleshooting. There are a number of things you should know about the Macintosh or Macintosh Plus to troubleshoot them effectively.

How to Use the Symptom Chart

Use the left-hand column to find the symptom that most nearly describes the problem of the defective unit. For that symptom, perform the corrective action(s) in the order listed. If a corrective action does not fix the problem, proceed to the next step. If a board is replaced but does not fix the problem, the original board should be reinstalled before you perform the next step.

Exchanging the Logic Board

If a customer requires a replacement Macintosh Plus logic board, compare the part numbers of the ROMs on the customer's board with those on the replacement board. If the ROMs are different, swap the them so that the customer keeps the same ROMs he started with. This must be down so that the customer's board is not downgraded.

Boot ROMs for the Macintosh Plus and Macintosh 512K Enhanced systems exist in several versions, which cannot be mixed on the same logic board. For more information refer to Section 6, Additional Procedures.

On 512K logic boards, verify that the ROMs on the exchange board are the same as the ones on the customer's board. If the ROMs are different, swap them so that the customer keeps the same ROMs.

Exchanging the Power/Sweep Board

When sending Apple a defective power/sweep board from a Macintosh or Macintosh Plus, be sure to include the power/sweep-to-logic-board cable. Make sure the contrast control knob and battery have been removed from the defective board and reinstalled onto the exchange board.

□ THINGS TO REMEMBER

1. Follow the basic ESD precautions when troubleshooting. (Refer to Section 2, Take-Apart, for more information.)
2. Be sure you read all the safety precautions before removing or installing any modules (refer to Section 1, Basics).
3. Be sure you discharge the CRT before removing or installing any modules. (Refer to Section 2, Take-Apart, for specific information.)
4. Be sure the software you use is known-good. Bad software can produce symptoms that appear to be hardware problems.
5. When exchanging the logic board or the power/sweep board, you must adjust the voltage. (Refer to Section 5, Adjustments, for complete instructions.)

❑ SYMPTOM CHART

Video Problems

Solutions

- *No video, but audio tone is present and drive operates*
 1. Turn contrast control fully counterclockwise.
 2. Check video cable connections.
 3. Replace neck cable.
 4. Replace power/sweep board.
 5. Replace logic board.

- *Screen is bright and audio is present, but no video information is present*
 1. Replace power/sweep board.
 2. Replace logic board.

- *Audio tone sounds at power on, video is present, but drive does not operate*
 1. Replace disk drive cable.
 2. Replace disk drive.
 3. Replace main logic board.

Drive Problems

Solutions

IMPORTANT: When exchanging an 800K drive, either internal or external, refer to *Section 6, Additional Procedures*, for exchange module compatibility information.

- | | |
|--|--|
| <ul style="list-style-type: none">• <i>Disk ejects, display shows disk icon with blinking "X"</i>
• <i>Unable to insert diskette all the way</i>
• <i>Drive will not eject diskette</i>
• <i>Will not read diskettes on internal drive</i>
• <i>Will not read diskettes on external drive</i>
• <i>Disk drive runs continuously</i> | <ul style="list-style-type: none">1. Replace bad diskette.2. Replace disk drive.3. Replace logic board.
<ul style="list-style-type: none">1. Insert a paper clip into the small hole beside the drive slot, or power off the system and hold the mouse button down while powering on to ensure the eject cycle has been completed. Then insert the diskette with the metal slot forward and the write protect tab on the bottom.2. Replace the disk drive.
<ul style="list-style-type: none">– Refer to Section 6, Additional Procedures.
<ul style="list-style-type: none">1. Replace bad diskette.2. Replace Mylar RFI shield.3. Replace internal drive.4. Verify ROMs on the logic board (refer to Section 6, Additional Procedures).5. Replace logic board.
<ul style="list-style-type: none">1. Replace bad diskette.2. Replace Mylar RFI shield.3. Replace external drive.4. Replace logic board.
<ul style="list-style-type: none">1. Replace bad diskette.2. Replace drive cable.3. Replace disk drive.4. Replace logic board. |
|--|--|

Peripheral Problems

Solutions

- *Cursor does not move*
 1. Connect mouse.
 2. Replace mouse.
 3. Replace logic board.
- *Cursor moves but clicking mouse produces no response*
 1. Replace mouse.
 2. Replace logic board.
- *No response to any key on keyboard*
 1. Replace keyboard cable.
 2. Replace keyboard.
 3. Replace logic board.
- *No response from a particular key*
 1. Replace keyswitch.
 2. Replace keyboard.
 3. Replace logic board.
- *Known-good ImageWriter or ImageWriter II will not print*
 1. Replace software with known-good.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Replace interface cable.
 4. Replace logic board.
- *Known-good LaserWriter will not print*
 1. Replace software with known-good.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Refer to *Apple Service Technical Procedures: Networks*.

Miscellaneous Problems

Solutions

- *When turned on, the Macintosh Plus continuously beeps and tries to power up*
 - Replace power/supply board, main logic board, and internal drive; then turn on the Macintosh Plus.
Replacing only the power/sweep board may damage the new power/sweep board.
- *Clicking or chirping sound*
 - 1. Connect logic board cable.
 - 2. Perform the voltage adjustment (refer to Section 5, Adjustments).
 - 3. Replace power/sweep board.
 - 4. Replace logic board.
- *Smoke/odor issues from the Macintosh*
 - Replace power/sweep board
- *No video, no audio tone, and no drive operation*
 - 1. Connect power cord.
 - 2. Turn power on.
 - 3. Replace power cord.
 - 4. Check fuse.
 - 5. Replace power/sweep board.
 - 6. Replace logic board.
- *MacTest displays 128K/512K when a 1 Megabyte Macintosh Plus is tested*
 - Replace Macintosh Plus logic board.
- *When the developer's switch is installed, the Macintosh Plus sometimes will reset intermittently*
 - Remove switch and file it down about 1/16 of an inch.

Special Problems

Solutions

- *Macintosh Plus hangs on startup*
 - If the logic board has the ROMs 342-0341-A or B (ROM HI) and 342-0342-A (ROM LO) and a peripheral device is connected to the SCSI port, the peripheral device must be turned on before powering on the Macintosh Plus. For additional information on ROM versions refer to Section 6, Additional Procedures.
- *Macintosh 512K Enhanced has two RFI Shrouds*
 - Some of these machines have two RFI shrouds installed. The two RFI shrouds can be replaced by one RFI shroud, which is orderable as a service part.
- *Stripped or lost Macintosh chassis screws*
 - Refer to Section 6, Additional Procedures.

Macintosh and Macintosh Plus

Section 5 – Adjustments

□ CONTENTS

5.2	Power/Sweep Voltage Adjustment
5.2	Introduction
5.2	Materials Required
5.3	Voltage Adjustment
5.4	Yoke Adjustments
5.4	Introduction
5.5	Materials Required
5.5	Adjustment Procedures
5.6	Video Adjustments
5.6	Introduction
5.6	Materials Required
5.7	Adjustment Procedures

□ POWER/SWEEP VOLTAGE ADJUSTMENT

Introduction

The voltages must be verified whenever the logic board or the power/sweep board is exchanged. If the voltages are outside of the specified tolerances, the adjustments must be performed.

The adjustments are done with the power on, and all voltage measurements are taken on the disk drive port with no peripheral devices attached. The internal disk drive should not be running when the measurements are being taken.

WARNING: Read and follow all the safety precautions in Section 1, Basics, before performing any adjustments. Failure to follow the safety rules could result in serious injury.

Materials Required

Macintosh voltage test cable
Plastic alignment tool
Digital voltmeter (accurate to within 0.01 volts)

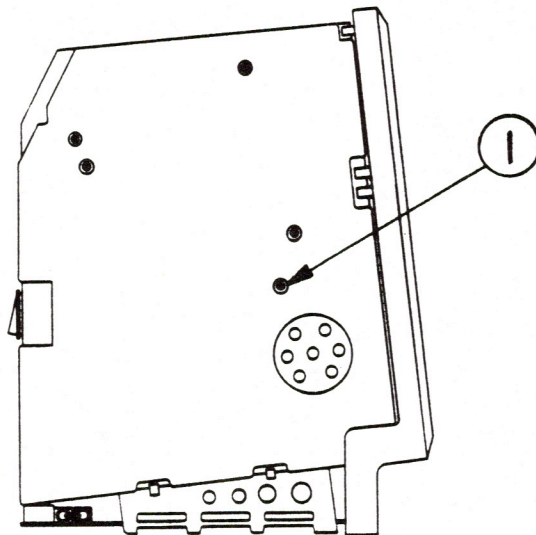


FIGURE 1

Voltage Adjustment

WARNING: *If the banana plugs on the test cable short to one another, the Macintosh will be damaged. Make sure that the banana plugs are insulated by their rubber hoods when not in use.*

1. The power should be off and the back cover removed. Connect the black test lead to the ground, set the proper range on the voltmeter, and plug the connector into the disk drive port on the rear of the Macintosh.

2. Connect the orange test lead (12 volts) to the input on the voltmeter. Power on the Macintosh.

The voltage reading must be between 11.90 and 12.3 volts. If the voltage is not within these tolerances, use the alignment tool to adjust the voltage regulator (Figure 1, #1) on the power/sweep board to 12.3 volts.

3. Power off the Macintosh. Disconnect the orange test lead and replace its insulating hood.
4. Connect the red test lead (5 volts) to the input on the voltmeter. Power on the Macintosh.

The voltage reading must be between 4.85 and 5.15 volts. If the voltage is not within these tolerances, use the alignment tool to adjust the voltage regulator (Figure 1, #1) on the power/sweep board to the specified limits.

6. Power off the Macintosh. Disconnect the red test lead and replace its insulating hood.
7. Repeat steps 2 through 6 to verify that both voltages are within the specified tolerance ranges.

If the power/sweep board cannot be adjusted so that both voltages fall within the tolerances indicated above, it should be exchanged.

□ YOKE ADJUSTMENTS

Introduction

If you replace the CRT, you will probably need to adjust the yoke. To determine if yoke adjustments are required, turn the power on and observe the CRT screen. If the picture is tilted, perform the tilt adjustment. If the picture is off center, perform the centering rings adjustment.

Yoke adjustments are made from the rear of the computer. You will need to position a mirror so that you can view the front of the computer. **Do not try to adjust by reaching around the computer;** you can't see what your hands are going to touch.

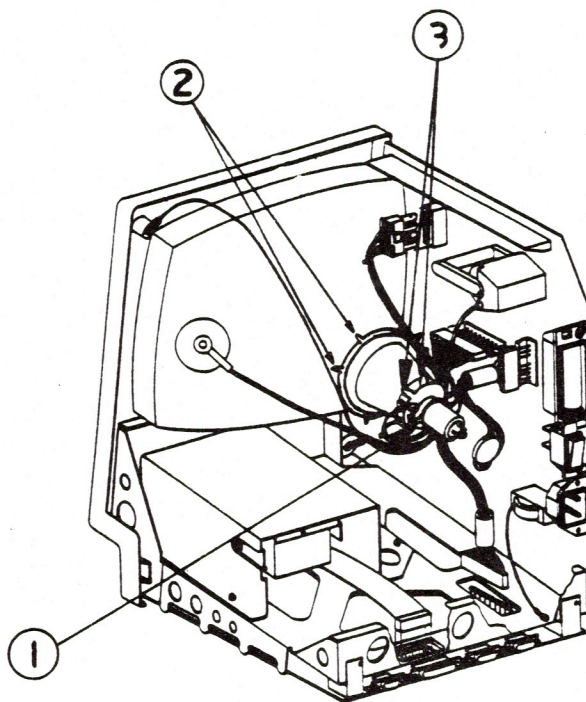


FIGURE 2

WARNING: Read and follow all the safety precautions in Section 1, Basics, before performing adjustments. Failure to follow the safety rules could result in serious injury.

Materials Required

Small flatblade screwdriver
CRT discharge tool
Soft cloth or foam pad
Mirror

Adjustment Procedures

Tilt

1. Remove the cover and discharge the CRT to the ground lug (refer to Section 2, Take-Apart).
2. Turn the computer with its back facing you and position the mirror so that the CRT screen is visible in the mirror.
3. Loosen the yoke clamp screw (Figure 2, #1) two or three turns.
4. Connect the power cord to the Macintosh, and then connect the other end to an electrical outlet. Turn the power on.
5. Put one hand behind your back and with your other hand grasp only the plastic spokes of the yoke collar (Figure 2, #2). Rotate the yoke and observe the effects on the picture. Rotate the yoke until the top and bottom edges of the picture appear parallel with the top and bottom edges of the bezel.
6. Turn the power off and unplug the computer. discharge the CRT to the ground lug. Hold the plastic collar in position and **carefully** tighten the yoke clamp screw just enough to so it does not slip. Do not overtighten.

Yoke Centering Ring

7. Connect the power cord and turn the power on. Locate the two centering rings on the yoke assembly (Figure 2, #3). The adjustment of these rings determines whether the picture is centered or offset to one side.
8. Rotate each ring about half a turn and observe the effect on the screen.
9. Now center the picture by first holding the front ring steady and moving the rear ring, then holding the rear ring steady and moving the front ring.

□ VIDEO ADJUSTMENTS

Introduction

Video adjustments are performed whenever the CRT or power supply/sweep board is replaced.

Materials Required

Alignment tool
Mirror
Ruler

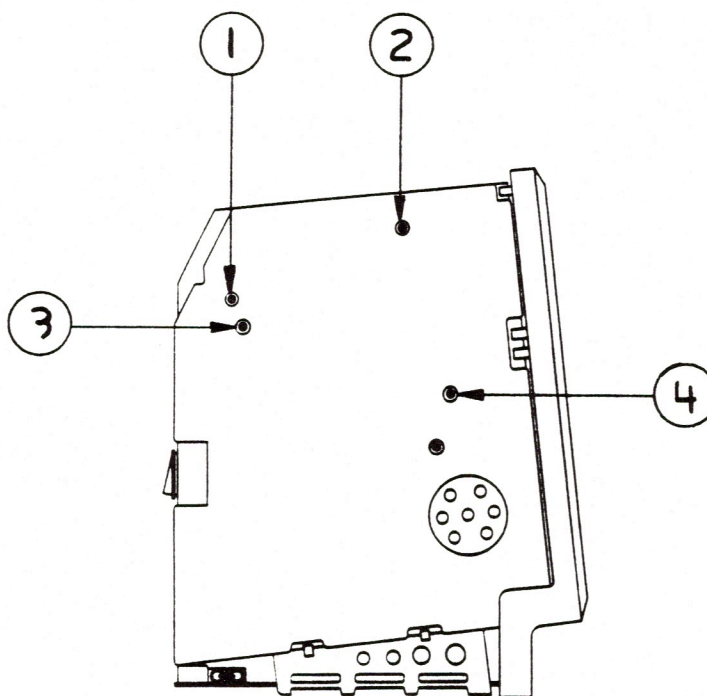


FIGURE 3

Adjustment Procedures

Brightness and Contrast

1. Put on safety goggles and remove all jewelry, including rings and necklaces.
2. Turn the contrast control fully clockwise. (The contrast control is on the front of the Macintosh, on the left hand side, under the Apple logo.)
3. Adjust the brightness control (Figure 3, #1) with the alignment tool: turn it fully counterclockwise so that white lines are visible on the screen. Then turn it back in the opposite direction until the white lines just disappear.

Size Adjustments

4. Turn the contrast control on the front panel a little bit counterclockwise. This is the ideal adjustment.
5. Use the alignment tool to adjust the width (Figure 3, #2) until the picture is approximately 7 inches wide.
6. Use the alignment tool to adjust the height (Figure 3, #3) until the picture is approximately 4.7 inches high.

Focus Adjustment

7. Turn the focus adjustment (Figure 3, #4) all the way clockwise until it doesn't turn anymore. Now turn it back in the opposite direction (counterclockwise) one-eighth of a turn. This setting gives the best overall sharpness at all points on the screen.

Macintosh and Macintosh Plus

Section 6 – Additional Procedures

❑ CONTENTS

6.2	Macintosh Plus Kits
6.2	Things to Remember
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6.5	Macintosh Plus Disk Drive Kit
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6.9	800K Drive Exchange Compatibility
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6.15	Alternate Chassis Screw Sizes
6.16	Removing the CRT Overspray
6.19	ROM Version Compatibility

❑ MACINTOSH PLUS KITS

WARNING: *There is high voltage and a high-vacuum picture tube inside the Macintosh computer. To prevent serious injury and property damage, make sure you read and follow the safety information and procedures found in Section 1, Basics.*

Things to Remember

When installing the Macintosh Plus Disk Drive Kit or the Macintosh Plus Logic Kit, pay special attention to the following:

1. Discharge the CRT as specified in Section 1, Take-Apart. Failure to do so can result in damage to the logic and power/sweep boards.
2. Follow the ESD prevention rules explained in Section 2, Take-Apart.
3. You may use 400K diskettes in the 800K drive, but be aware that the 800K drive may emit a squealing sound. This does not indicate a problem and will not cause damage to either the diskette or the 800K drive.
4. The shipping instructions must be followed **exactly** as stated on the sheet included with the kit.
5. The 800K disk drive is shipped with a packing diskette installed. This packing diskette should be given to the customer. Whenever the machine is transported, the packing diskette should be inserted to prevent damage to the drive.
6. Remind your customers that all their diskettes have to be updated with the most recent system files. The files are included in the kit and should be given to customers. Instructions for performing the system file upgrades are given in the manuals that accompany the kits.
7. When the Drive Kit is installed, the customer should be given the *Macintosh Plus Internal Drive Manual*.

8. When the Drive Kit and the Logic Board Kit are installed, the customer should be given the Peripheral Adapter Cable, the *Macintosh Plus Owner's Guide*, the *Macintosh Plus Internal Drive Manual* and the *Macintosh Plus Information Sheet*.
9. The Macintosh Plus will display a gray screen for 5 to 10 seconds before booting from any diskette. (The Macintosh Plus is running a self-check.)
10. The Macintosh Plus Disk Drive Kit is not recommended for the 128K Macintosh.
11. Insert the yellow packing diskette into the new 800K disk drive to prevent damage during transport.

Disk Drive and Logic Board Kits

If you are installing the Macintosh Plus Disk Drive and Logic Board Kit at the same time, follow these steps:

1. Turn to "Macintosh Plus Disk Drive Kit" and follow steps 1-4, 7, and 8.
2. Turn to "Macintosh Plus Logic Board Kit" and follow steps 5-9.
3. Insert the yellow packing diskette into the new 800K disk drive.
4. Return the **old** ROMs, the 400K drive, and the **old** 128K/512K logic board to Apple as instructed in the kits.

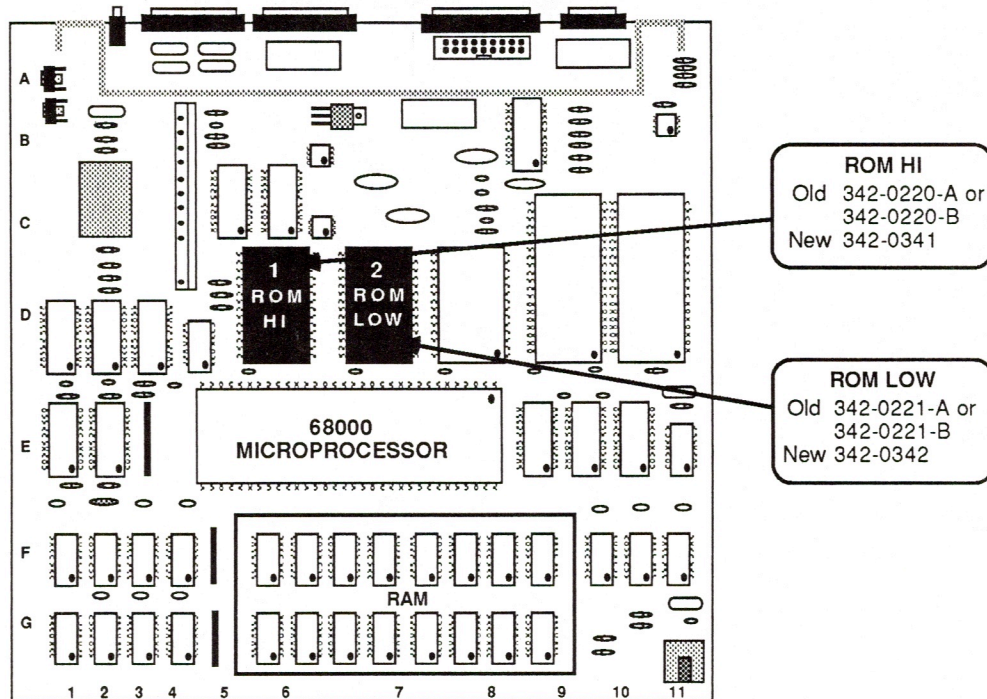


FIGURE 1

Macintosh Plus Disk Drive Kit

Read "Things to Remember" before beginning.

The Macintosh Plus Disk Drive Kit contains an 800K internal disk drive and two new boot ROMs. When installing it, you will replace the 400K internal disk drive and two socketed boot ROMs on the 512K Macintosh logic board. The new ROMs will support both the 400K and 800K external disk drives.

Return Information

The shipping instructions must be followed **exactly** as stated on the sheet included with the Macintosh Plus Drive Kit.

Procedures

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the rear housing and RFI shroud.
3. Discharge the CRT as specified in Section 2, Take-Apart.

WARNING: *Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.*

4. Remove the Macintosh logic board. Using an IC extractor, remove the old ROMs installed at locations D5 and D8. (Refer to Figure 1, Macintosh 128K/512K Logic Board.)
5. Install the two new ROMs in the appropriate locations: ROM HI (P/N 342-0341) at location D5, ROM LOW (P/N 342-0342) at location D8. (Refer to Figure 1, Macintosh 128K/512K Logic Board.) There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Remove the internal disk drive (refer to Section 1, Take-Apart).
7. Reinstall the Macintosh logic board and install the new 800K internal disk drive.
8. Replace the RFI shroud and rear housing.
9. Run *MacTest* to verify that the machine is still working correctly.
10. Return the old ROMs and 400K disk drive to Apple (refer to instructions included in the kit).

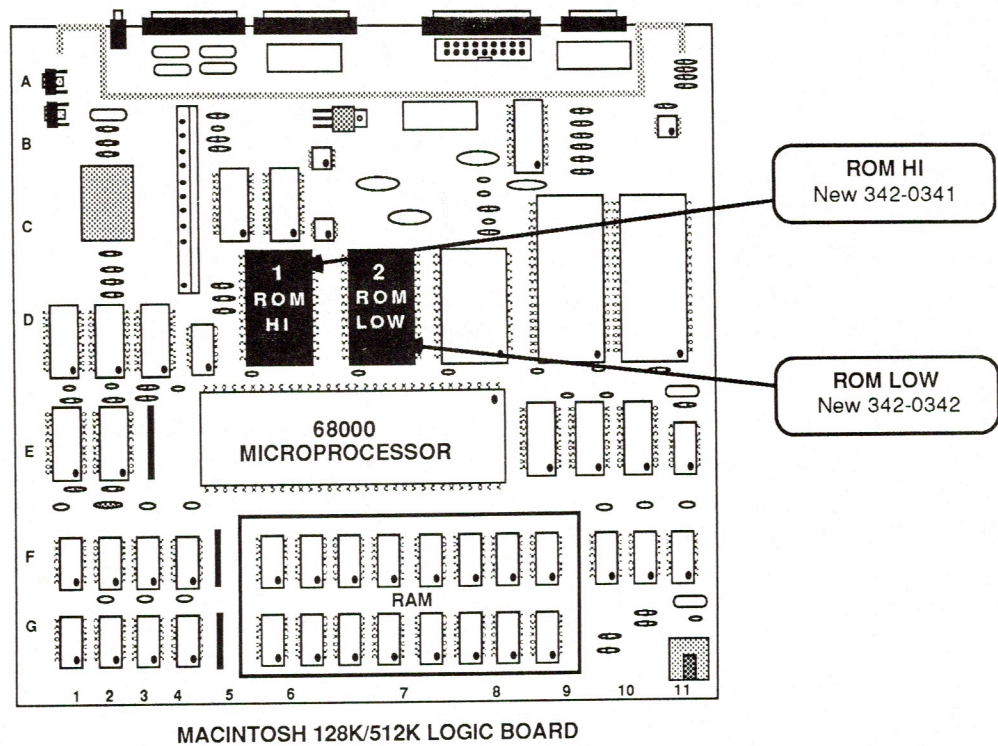


FIGURE 2

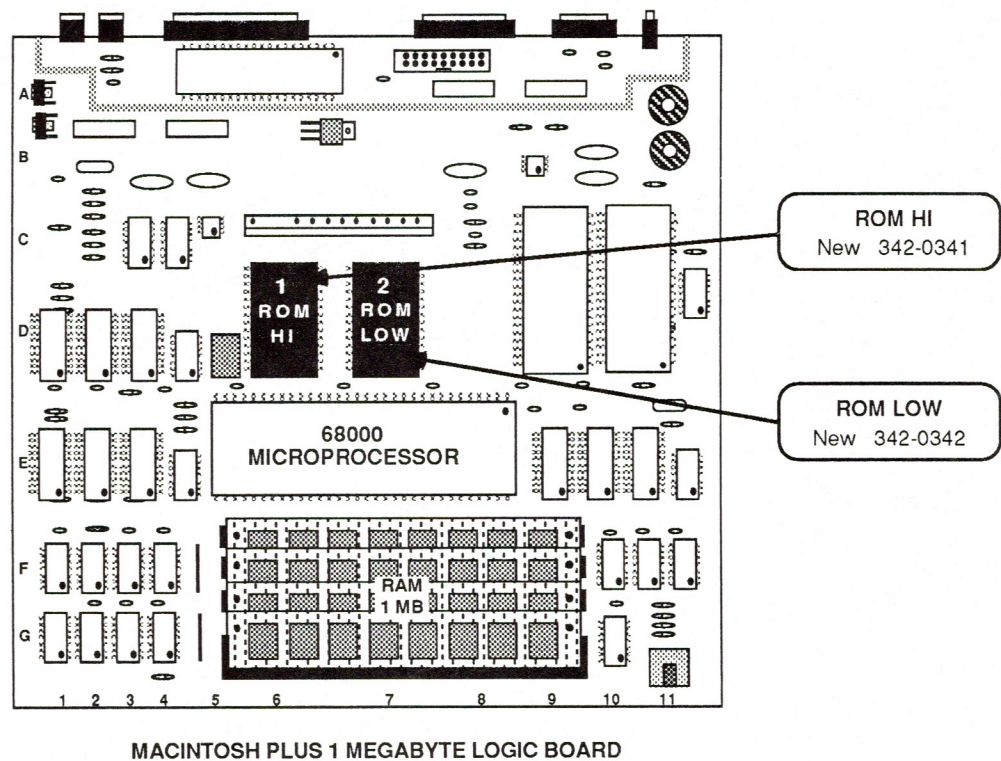


FIGURE 3

Macintosh Plus Logic Board Kit

Read "Things to Remember" before beginning.

The Macintosh Plus Logic Board Kit cannot be installed unless the Disk Drive Kit has been installed. You will need the new ROMs which were installed for the Disk Drive Kit. The Logic Board Kit includes a Macintosh Plus logic board with 1 megabyte of memory, an RFI shroud, and a new rear housing.

Return Information

The shipping instructions must be followed **exactly** as stated on the sheet included with the Macintosh Plus Logic Board Kit.

Procedures

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the old rear housing and RFI shroud.
3. Discharge the CRT as specified in Section 1, Take-Apart.

WARNING: *Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.*

4. Remove the 128K/512K Macintosh logic board. Using an IC extractor, remove the two Revision D ROMs. ROM HI is at location D5, and ROM LOW is at location D8. (Refer to Figure 2, Macintosh 128K/512K Logic Board.)
5. Install the two ROMs in the appropriate locations on the **new** logic board: ROM HI (P/N 342-0341) at location D5, ROM LOW (P/N 342-0342) at location D8. (Refer to Figure 3, Macintosh Plus 1 Megabyte Logic Board.) There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Install the **new** Macintosh Logic Board with the ROMs. Install the **new** RFI shroud and the **new** rear housing.
7. Run *MacTest* to verify that the machine is still working correctly.
8. Return the old logic board (with no ROMs), the old RFI shroud and the old rear housing to Apple.

❑ SPECIAL PROBLEMS

800K Drive Exchange Compatibility

There are three series of 800K drive mechanisms. All three mechanisms can be used as an internal drive, but only with the cable specified below. If you do not use the correct cable, the drive will not work correctly.

<i>Series Number</i>	<i>Cable Needed</i>
MFD-51W-03 (Red on Silver Label)	Yellow
MFD-51W (Black on Silver Label)	Red
51W-10 (Black on Silver Label)	Red

For additional information refer to the *Disk Drive* tab.

800K Diskette Ejection Problems

Whenever a diskette from an internal or external 800K drive does not fully eject, the user must push the diskette back in and attempt to eject it electronically.

CAUTION: *If the diskette becomes "frozen" and does not fully eject, the user must not force the diskette by pulling it out from the drive. Using force may result in damage to the mechanism.*

The following three ways of ejecting the diskette should be tried.

1. Hold down the <Shift> and <Command> keys and press 1 (for the internal drive) or 2 (for the external drive).
2. Pull down the **File** menu and select **Eject**. Attempt this two or three times.
3. As a last resort, the user can insert a paper clip in the pin hole located beneath and to the right of the slot where the diskette is inserted.

The following factors can also affect the insertion and ejection of a diskette.

- A diskette should be inserted by pressing the diskette gently into the drive. Avoid grasping and pushing the diskette, as this may cause the diskette to go in only part way and stop. If this happens, the user should attempt to eject the diskette as described above.
- Diskettes with three or more labels may not slide easily into and out of the diskette slot in the Macintosh case. If a third label is required, either remove the other labels first or discard the diskette.

Technicians should also be careful when removing or installing a disk drive mechanism. If the diskette opening in the disk drive mechanism is not properly centered, binding or friction may cause ejection problems. If the internal mounting bracket is warped or bent, the drive will not align properly with the bezel and the mounting bracket will need to be exchanged. Refer to Section 2, Take-Apart, for the proper installation procedure.

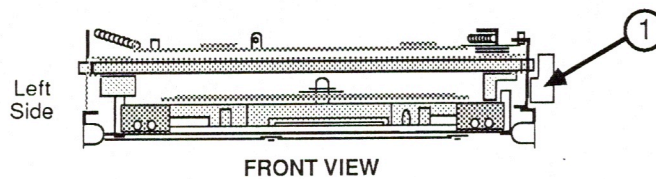


FIGURE 4

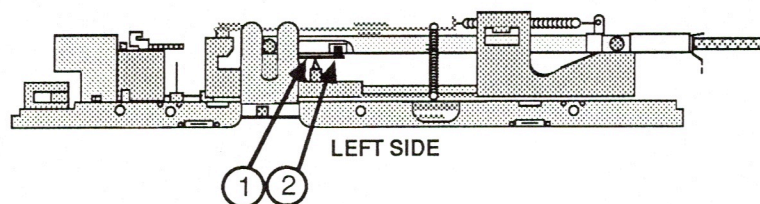


FIGURE 5

*Removing
Diskettes That
Will Not Eject*

If a diskette becomes "jammed" in a customer's disk drive, use the following procedure to remove it before you return the disk drive.

1. Remove the disk drive (refer to Section 2, Take-Apart).
2. Place the disk drive and RFI shield assembly upside down on a flat surface.
3. Remove the four screws securing the disk drive mechanism to the RFI shield.
4. Remove the disk drive mechanism from the RFI shield.
5. Place the disk drive mechanism on a flat surface, with the printed circuit board facing down and the diskette opening facing you (Figure 4).

If the diskette is not already fully inserted into the disk drive, push it in until it is properly seated.

6. Press the eject lever at the right side of the disk drive (Figure 4, #1).

Turn the disk drive so that the left side is facing you.

7. Locate the small arm with a cylindrical cog at its end. This arm is located near the left-to-right center of the drive mechanism (Figure 5, #1). The cog will be caught in the half-moon depression of the diskette case.
8. Insert a small screwdriver at the position shown in Figure 5, #2, and gently move the arm away from the diskette until the diskette pops forward slightly. Remove the diskette from the disk drive.
9. Return the defective disk drive to Apple and follow the instructions in Section 2, Take-Apart, to align the new disk drive with the front bezel.

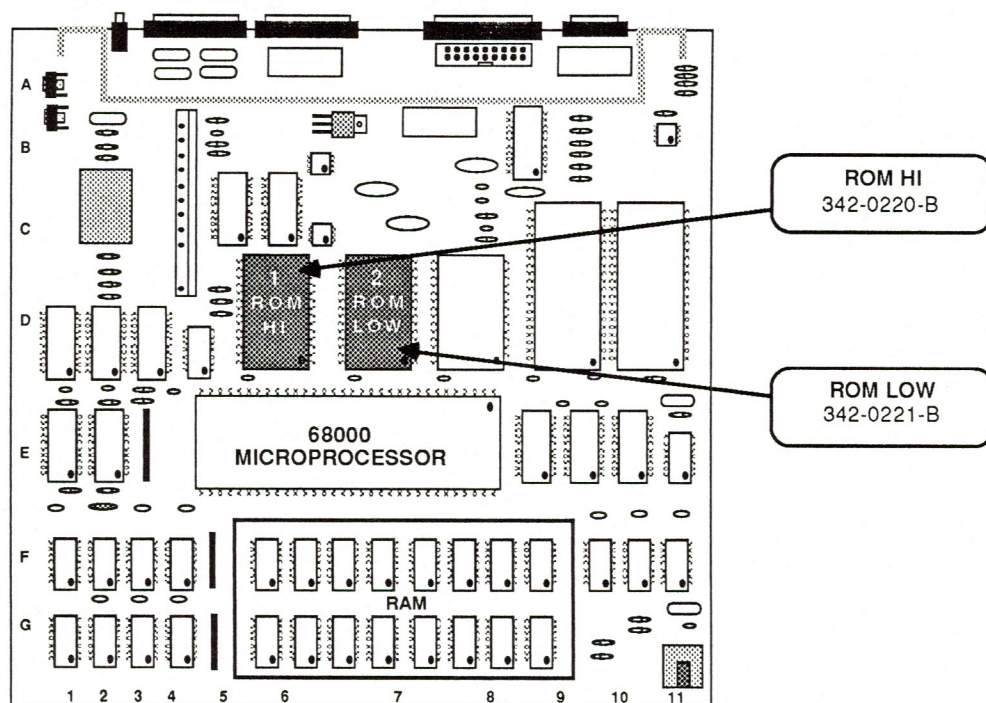


FIGURE 6

Logic Board ROM Upgrade and 400K Drives

Installation Procedures

Current 400K disk drives contain a new stepper motor, which may require the replacement of the two boot ROMs on older Macintosh logic boards (both 128K and 512K). Both of these ROMs are socketed. The new ROMs are compatible with both the new and old stepper motors.

The 128K/512K Macintosh should have ROM HI 342-0220-B at location D5, and ROM LOW 342-0221-B at location D8. If these ROMs are not installed, you will need to upgrade the logic board by replacing the boot ROMs.

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the cover and discharge the CRT (refer to Section 2, Take-Apart).

WARNING: *Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.*

3. Remove the Macintosh logic board. Referring to Figure 6, locate the two ROMs and verify that the old ROMs are installed.
4. Using an IC extractor, remove the ROMs and place them on a piece of antistatic foam.
5. Install the new ROMs in the appropriate location [ROM HI (P/N 342-0220-B) at location D5, ROM LOW (P/N 342-0221-B) at location D8]. There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Reinstall the Macintosh logic board.
7. Replace the back cover.
8. Run *MacTest* to verify that the machine is still working correctly.

Alternate Chassis Screw Sizes

Some Macintosh systems have been shipped with non-standard chassis screws. The standard Macintosh uses three 2.9 x 10mm screws to attach the power/sweep board to the chassis, and one 2.9 x 6mm screw to attach the ground lug to the chassis. The non-standard systems use one of the following types of screw for both the board and the ground lug:

#6 x 3/8" Type A sheet metal screw, Phillips pan head, with external tooth start washer attached, steel, with zinc or cad plating.

#4-40 x 3/8" machine screw

To determine which screw is needed, compare the screw holes with the figures below. Systems with pem nuts or nutserts (Figure 7 and 8) use the machine screw. Systems without them (Figure 9) use the sheet metal screw.

These screws are available at any hardware store.

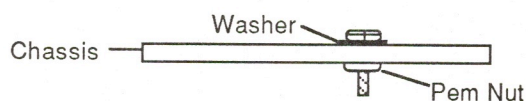


FIGURE 7

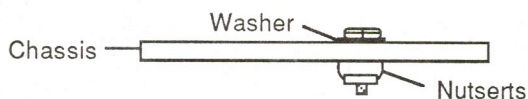


FIGURE 8

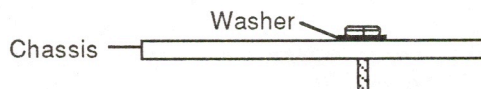


FIGURE 9

❑ REMOVING THE CRT OVERSPRAY

Introduction

Macintosh CRTs have a conductive coating (Figure 10, #1), which is sprayed on. Certain CRTs have been sprayed with too much of this coating, especially near the ears of the CRT (Figure 10, #2). This overspray will occasionally cause them to produce an electrical discharge (arc) to the bezel near the "ears" on the CRT, causing electrical interference to the CPU. This may result in a "Serious System Error" message or "garbage" displayed on the screen. You may also hear "screaming" or "squealing" noises when this occurs. Turning power off and then back on will usually restore normal operation.

The following procedure will correct this problem. The procedure consists of cutting away some tape with a knife, scrubbing away some spray coating on the CRT, and installing four mylar washers between the CRT "ears" and the bezel.

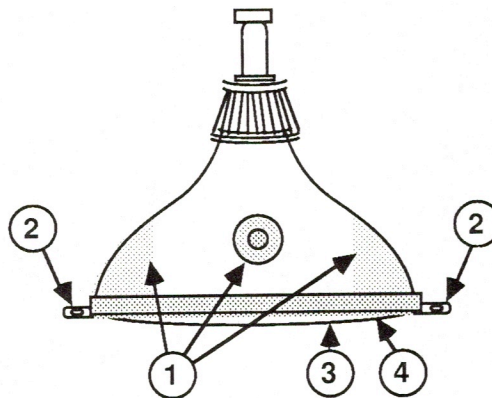


FIGURE 10

Materials Required

Rubbing Alcohol
X-acto knife
Mylar washers (4)
Rags or paper towels for cleaning up
Small stiff brush (a very stiff toothbrush or a cut-off acid brush works best)

WARNING: *There is high voltage and a high-vacuum picture tube inside the Macintosh computer. To prevent personal injury and property damage, make sure you have read the safety information in Section 1, Basics, before you perform this procedure.*

Procedure

1. Put on safety goggles and remove the CRT (refer to Section 2, Take-Apart). **Make sure the CRT has been discharged and the anode wire removed before going on to step 2.**
2. Place the CRT face down on a workbench so that you are viewing the area shown in Figure 10.
3. Inspect the area around the bottom of the metal band that goes around the CRT. If the CRT has any adhesive tape extending out from under the band (Figure 10, #1), hold the CRT steady with one hand (be careful not to touch the anode) and use an X-acto knife to cut the tape back to the edge of the band. Cut away the tape on all sides of the CRT. If there is no tape extending out, go on to the next step.
4. Check along the bottom edge of the band for any overspray of the conductive spray (Figure 10, #2). Scrub the glass along the edge of the band with a brush that has been dipped in rubbing alcohol.
5. Now check your work: the area below the edge of the band should be shiny like the glass on the screen of the CRT. Any dull or dark-looking areas should be scrubbed again.

...Continued on next page

6. With the bezel face down, apply a mylar washer to each of the four CRT mounting holes on the bezel (Figure 11, #1). Each washer should be centered with its center hole matching the screw hole in the bezel.
7. Make sure that the face of the CRT is clean, and then carefully seat the CRT on the bezel and install the CRT mounting screws.
8. Connect the anode wire to the CRT and replace the cover.

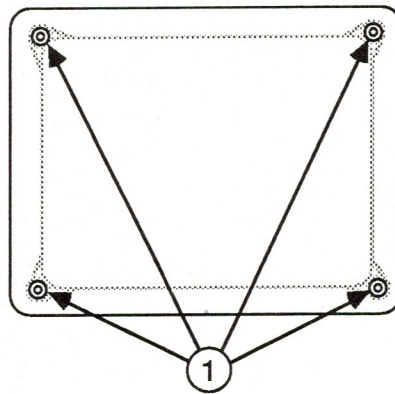


FIGURE 11

❑ ROM VERSION COMPATIBILITY

Starting in March, 1987, the Macintosh Plus, the Macintosh 512K Enhanced, and the 800K disk drive upgrade kit will be shipped with a new set of ROMs. These ROMs correct the SCSI device problems that were being experienced with older ROMs. The new ROMs are fully compatible with 512K systems. The only rule—**do not mix old and new ROMs**.

The following list gives the part number and the version letter of the old and new ROMs.

	Old ROMs	New ROMs
High:	342-0341-B	342-0341-C
Low:	342-0342-A	342-0342-B

Macintosh and Macintosh Plus

Section 7 – Illustrated Parts List

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- 7.3 Macintosh External Housing (Figure 1)
- 7.5 Macintosh/Macintosh Plus Chassis & Power Supply (Figure 2)
- 7.7 Macintosh Exploded Assembly (Figure 3)
- 7.9 Macintosh Keyboard Assembly (Figure 4)
- 7.11 Macintosh Numeric Keypad Assembly (Figure 5)
- 7.13 Macintosh Plus Rear Housing (Figure 6)
- 7.15 Macintosh Plus Exploded Assembly (Figure 7)
- 7.17 Macintosh Plus Keyboard Assembly (Figure 8)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Macintosh, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

Note: Only those items which are unique to the Macintosh Plus are called out on Figures 6, 7 and 8.

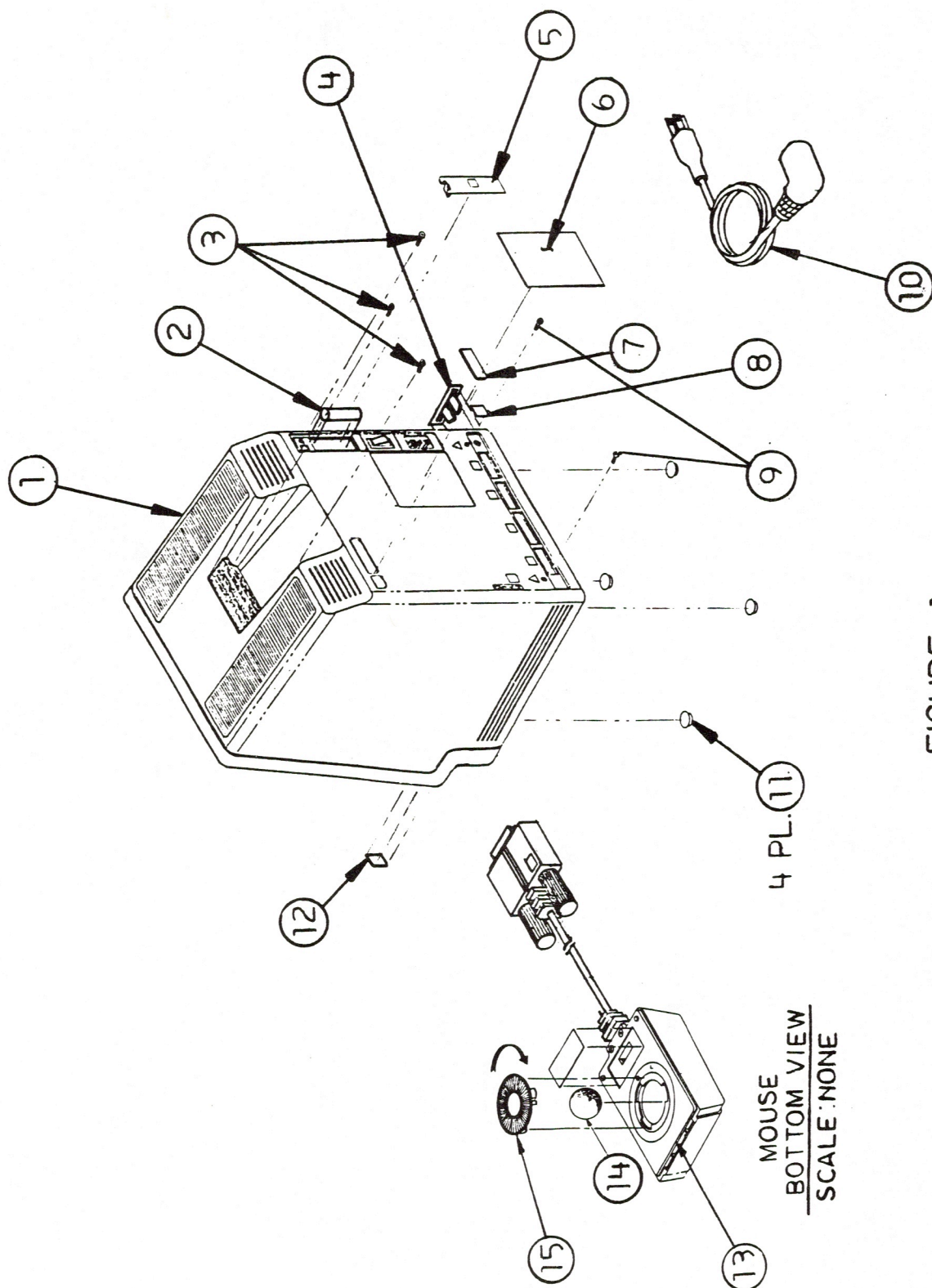


FIGURE 1

□ MACINTOSH – EXTERNAL HOUSING (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5139	Rear Housing with Label
2	742-0003	Battery, Alka, 4.5V
3	435-5002	Screw, Tap 8-32 x .625 Fill, Torx, Zinc Oxide (Main Case)
4	815-0737	Development System Pushbutton, Beige (Reset Button)
	815-0763	Development System Pushbutton, Smoke (Reset Button)
5	815-0938	Macintosh Battery Door, Beige
	815-0971	Macintosh Plus Battery Door, Platinum
6	825-4018	Agency Approval Label
	825-1014	Agency Approval Label, 512K enhanced
7	825-0742	Macintosh Label
	825-1065	Macintosh Signature 512K Label
8	825-0613	Logo Label (Housing)
9	422-1007	Screw, Tap, 4.21 x 1.41 x 16 (Main Case)
10	590-0138	Power Cable, Beige
	590-0131	Power Cable, Smoke
11	865-0051	Macintosh Foot
12	825-0547	Logo Label (Bezel)
13	661-96155	Macintosh Mouse
	661-0400	Apple Mouse, Platinum
14	699-8001	Rubber-Coated Mouseball
15	815-0409	Mouseball Retainer

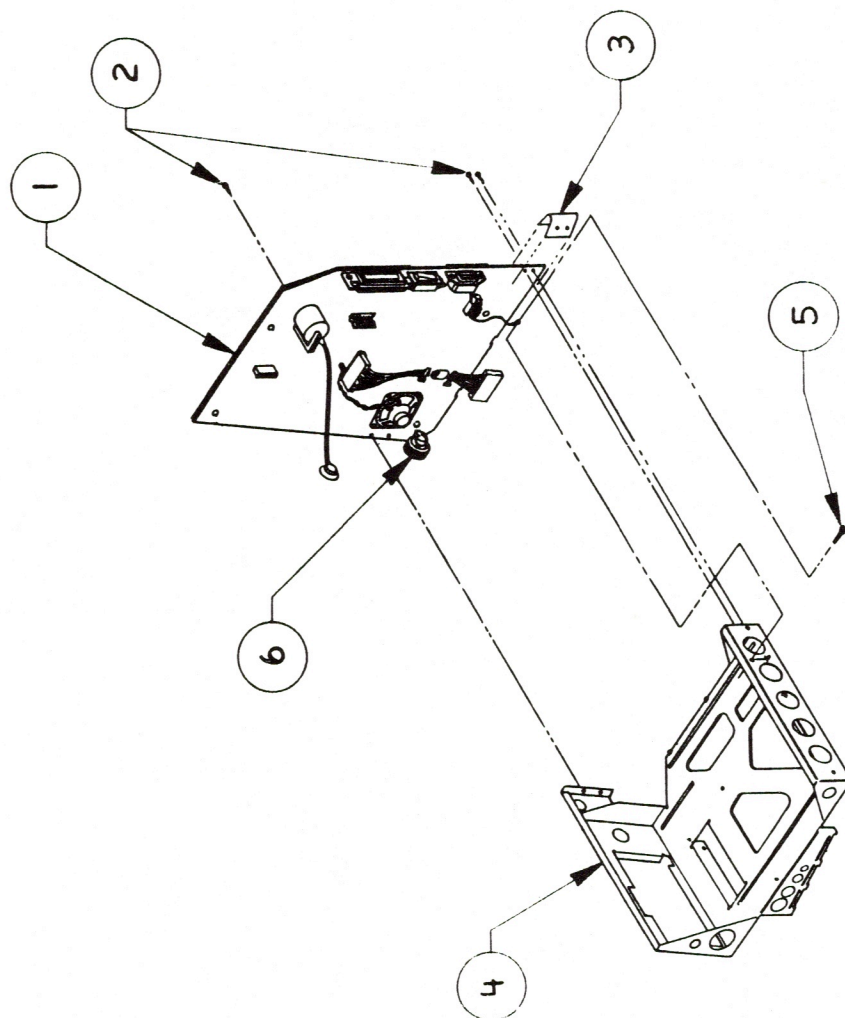


FIGURE 2

❑ **MACINTOSH/MACINTOSH PLUS – CHASSIS AND POWER
SUPPLY (Figure 2)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-76153	Power Supply
2	470-2101	Screw, 2.9 x 10 mm
3	805-0576	Lower Ground Clip
4	805-0766	Macintosh Chassis
5	470-2100	Screw, 2.9 x 6 mm
6	865-0019	Brightness Knob, Beige
	865-0029	Brightness Knob, Smoke

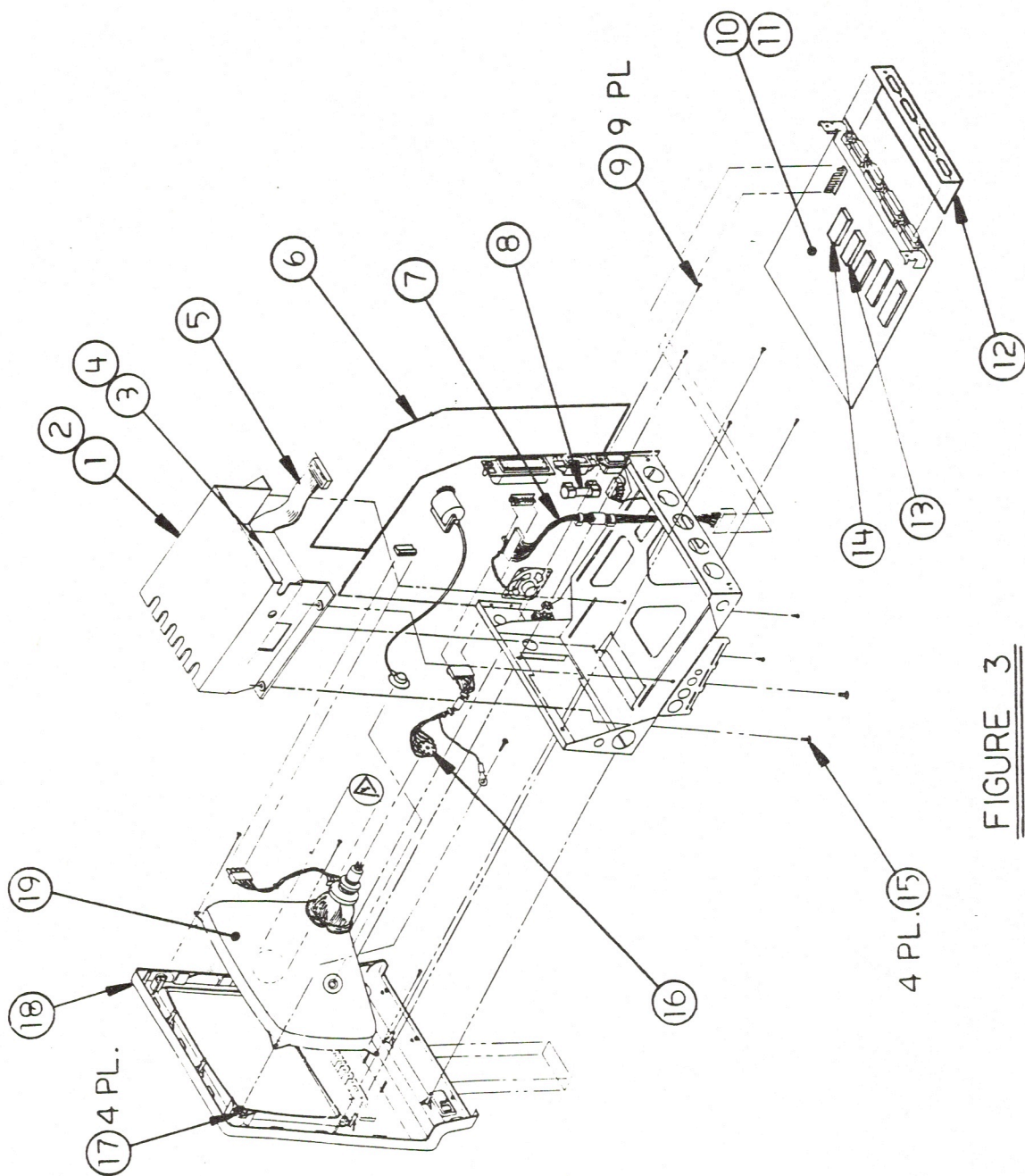


FIGURE 3

□ MACINTOSH – EXPLODED ASSEMBLY (Figure 3)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0574	Shield for Internal Drive
2	805-0217	Shield for Internal 800K Drive (512K enhanced)
3	661-76156	Micro Disk Assembly, 400K
4	661-0345	800K Mechanism, Apple 3.5 Drive (512K enhanced)
5	590-0167	3-1/2" Drive Cable Internal (Red Striped)
	590-0437	3-1/2" Drive Cable Internal (Yellow Striped)
6	725-0011	Insulator Shield (Back of Power Supply)
7	590-0184	Power Supply to Logic Cable
8	740-0300	U.S. Power Supply Fuse, 2.5A 250VAC 740-0060 Int'l Power Supply Fuse, 1.6A 250V
9	422-1007	Screw, Tap 4.21 x 1.41 x 16 (Main Case)
10	661-96152	128K Main Logic Board*
11	661-96236	512K Logic Board*
12	805-0577	RFI Shroud
13	342-0221	IC, ROM Low**
14	342-0220	IC, ROM High**
15	462-3100	Screw, M3 x .5 x 6
16	590-0160	CRT Socket Cable
17	725-0018	Mylar Washer
18	810-0373	Front Bezel
19	076-0103	CRT and Yoke Assembly

* If the logic board fails, refer to Section 6, Additional Procedures, for instructions.

**These ROMS are used on 128K Logic Boards and on 512K Logic Boards that have not been upgraded with ROMS that support the 800K Disk Drive.

Part numbers 342-0220 and 342-0221 are listed on the Price Pages of the *Apple Service Programs* manual as "Other Parts."

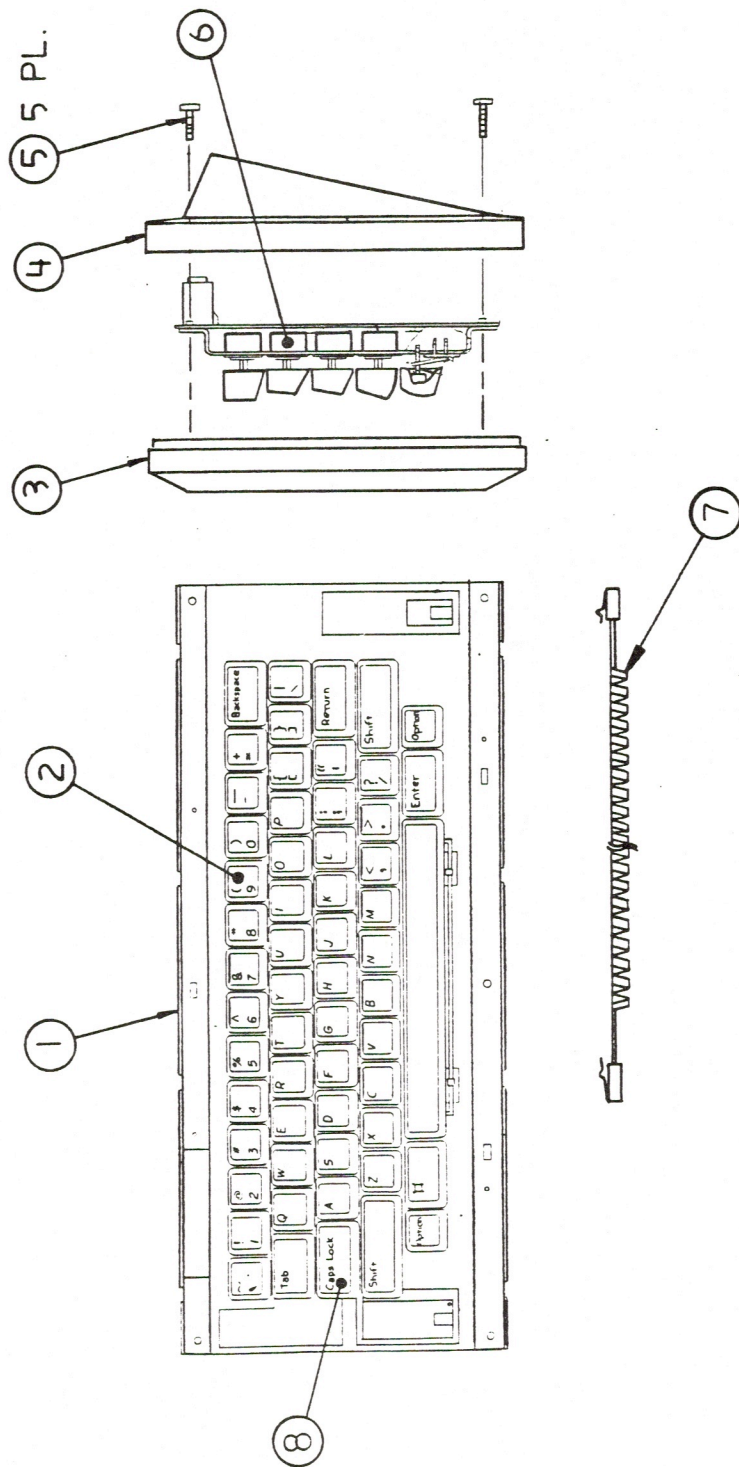


FIGURE 4

□ MACINTOSH – KEYBOARD ASSEMBLY (Figure 4)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-96154	Keyboard with Cable
2	658-7039	Keycap Set
3	815-0728	Cover, Top Keyboard
4	815-0754	Cover, Bottom Keyboard
5	430-1025	Screw, Tap 2.20 x 6.25 (Keyboard Case)
6	705-0070	Alps Long Stem Keyswitch, Macintosh/ Macintosh Plus*
7	590-0144	Keyboard/Keypad Cable, Beige
	590-0170	Keyboard/Keypad Cable, Smoke
8	705-0077	Alps Alpha Lock Keyswitch, Macintosh/ Macintosh Plus*

Note: Keycaps are not available for international keyboards. For Macintosh Plus keycap set, see Figure 8, "Macintosh Plus Keyboard Assembly."

*Refer to keyswitch identification in **Appendix** section.

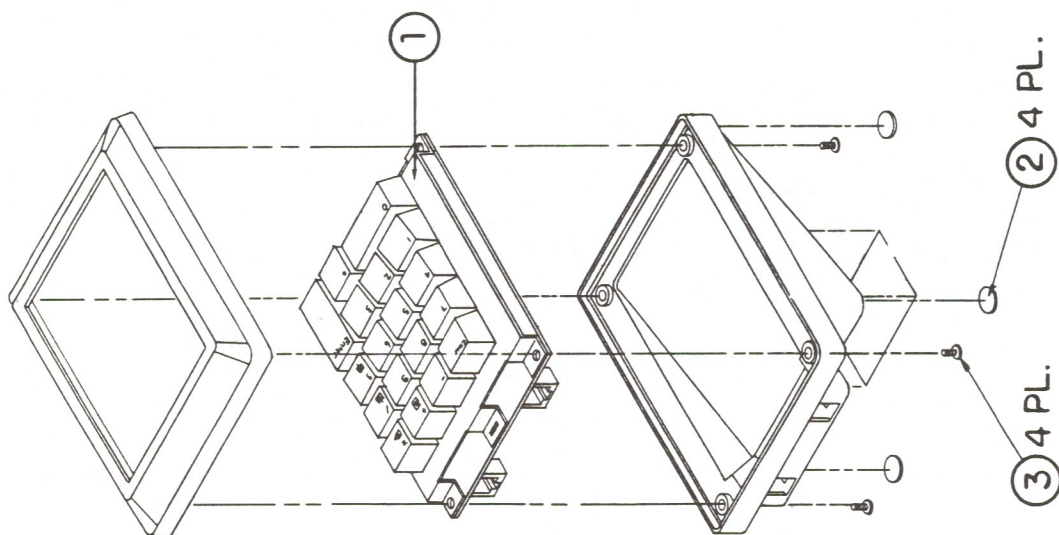


FIGURE 5

□ MACINTOSH – NUMERIC KEYPAD ASSEMBLY (Figure 5)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	658-4045	Keypad Assembly
2	865-0051	Macintosh Foot
3	430-1025	Screw, Tap, 2.2 x 6.25

Note: The keyswitch used on the Macintosh Numeric Keypad is the same as that on the Macintosh Keyboard: Alps Longstem Keyswitch (p/n 705-0070). See Appendix A for illustration.

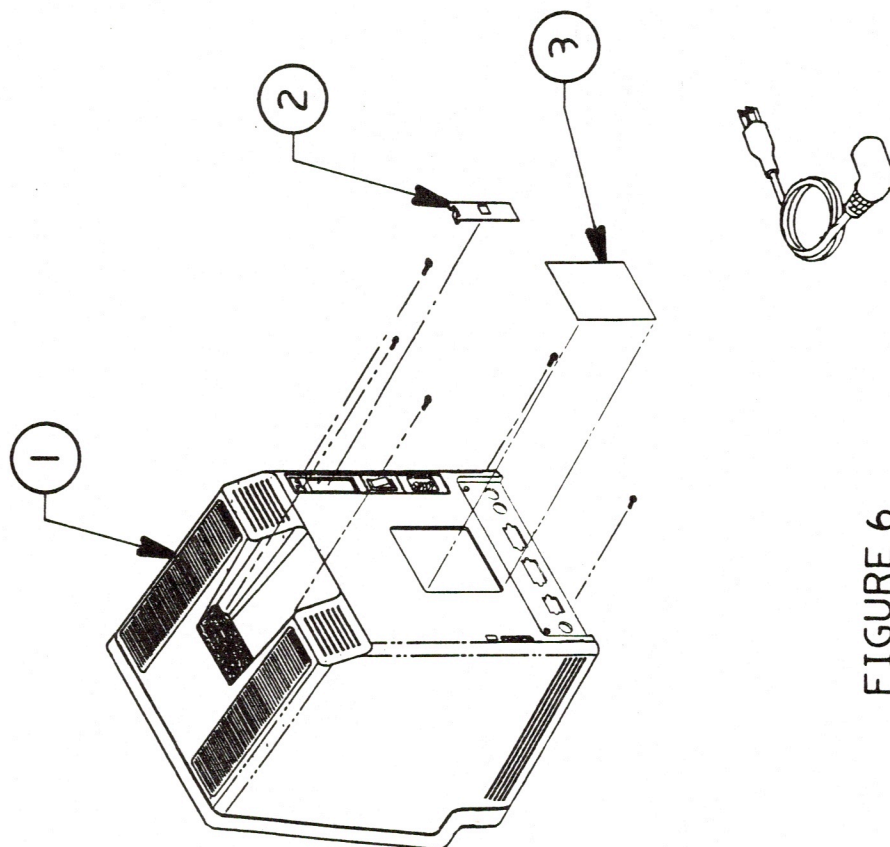


FIGURE 6

□ MACINTOSH PLUS – REAR HOUSING (Figure 6)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5211	Macintosh Plus Rear Housing with Labels, Beige
	630-5235	Macintosh Plus Rear Housing with Labels, Platinum
2	815-0938	Macintosh Plus Battery Door, Beige
	815-0971	Macintosh Plus Battery Door, Platinum
3	825-1254	Macintosh Plus Agency Approval Label, Beige
	825-1345	Macintosh Plus Agency Approval Label, Platinum

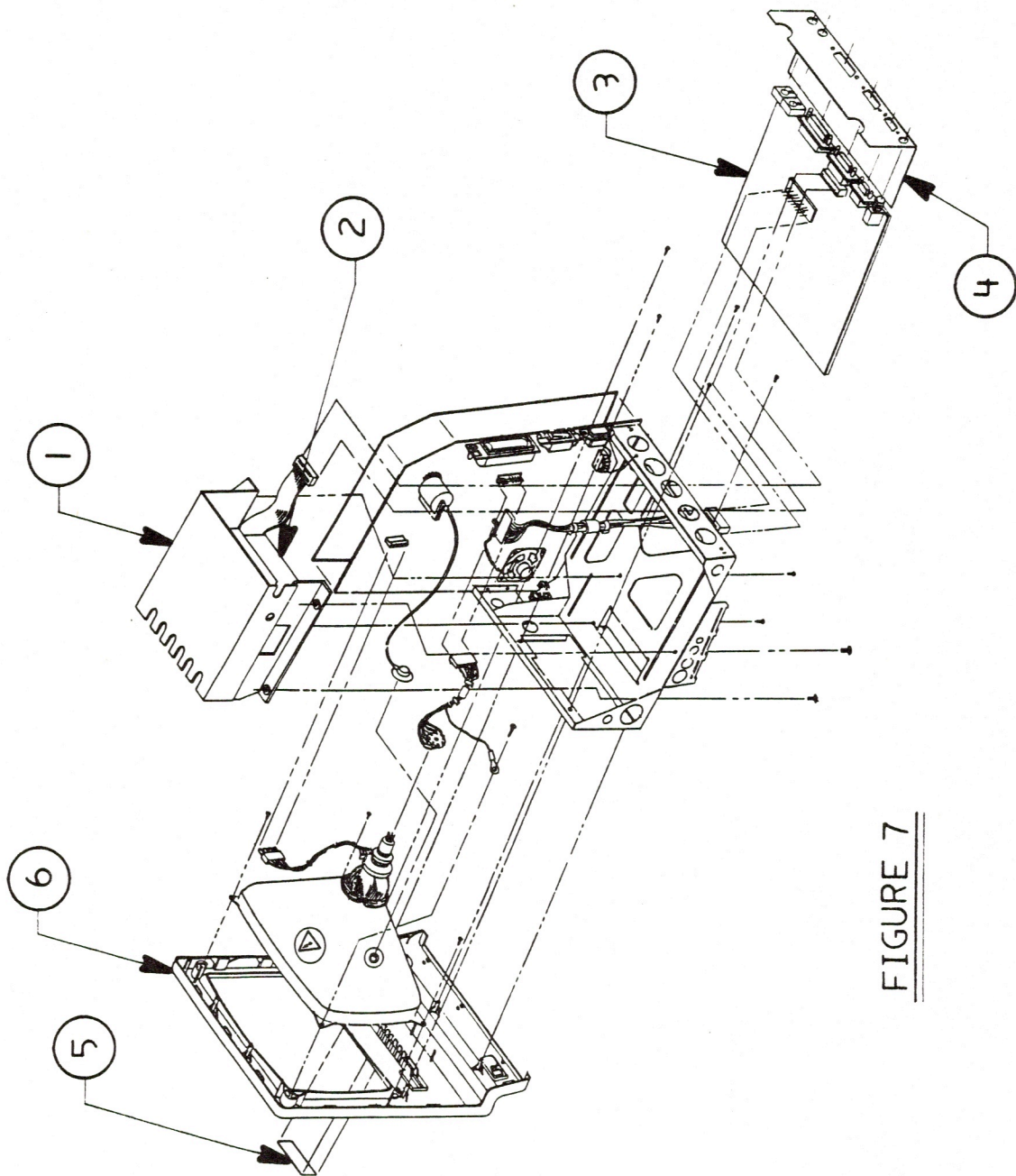


FIGURE 7

□ MACINTOSH PLUS – EXPLODED ASSEMBLY (Figure 7)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0217	Shield for Internal Drive (Shipping Fixture)
2	661-0305	Drive Mechanism, 800K
3	661-0321	Macintosh Plus Logic Board
4	805-5047	Macintosh Plus RFI Shroud
5	825-1256	Macintosh Plus Logo Plate Label
6	810-0379	Macintosh Plus Front Bezel

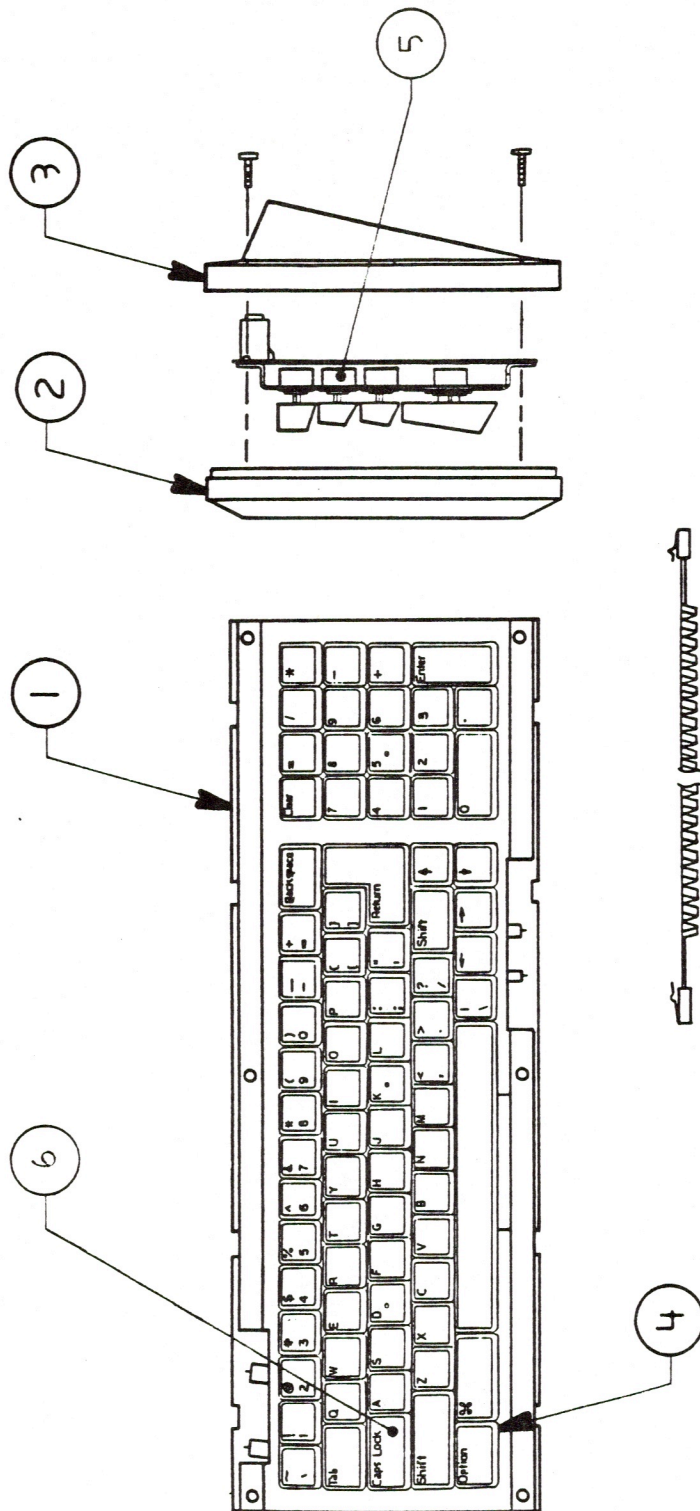


FIGURE 8

□ MACINTOSH PLUS – KEYBOARD ASSEMBLY (Figure 8)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0322	Macintosh Plus Keyboard, Beige (with cable)
	661-0416	Macintosh Plus Keyboard, Platinum (with cable)
2	815-0936	Top Cover, Macintosh Plus K/B, Beige
	815-0983	Top Cover, Macintosh Plus K/B, Platinum
3	815-0937	Bottom Cover, Macintosh Plus K/B, Beige
	815-0984	Bottom Cover, Macintosh Plus K/B, Platinum
4	658-5186	Macintosh Plus Keycap Set, Beige
	658-5190	Macintosh Plus Keycap Set, Smoke
5	705-0104	Mitsumi Keyswitch*
	705-0070	Alps Long-Stem Keyswitch, Macintosh/ Macintosh Plus*
6	705-0044	Mitsumi Locking Keyswitch*
	705-0077	Alps Alpha Lock Keyswitch, Macintosh/ Macintosh Plus*

*Refer to keyswitch identification in Appendix section.

**End of Macintosh/
Macintosh Plus
Section Start of
Macintosh SE Section**

Macintosh SE

Technical Procedures

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IPL.21	Mouse (Figure 11)
IPL.23	Service Packaging, 3.5 HDA (Figure 12)

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Macintosh SE

Section 1 – Basics

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□ PRODUCT DESCRIPTION

Features

The Macintosh™ SE is an enhanced Macintosh Plus that supports internal and external customized expansion options. This new Macintosh contains an internal connector for expansion of the CPU bus. The system comes with 1 megabyte of RAM installed, with upgrades to 2.5 and 4 megabytes available. The customer has a choice of two drive configurations:

- Two internal 800K floppy disk drives
- One internal 800K floppy disk drive and one internal SCSI hard disk drive

The Macintosh SE supports the same peripherals as the Macintosh Plus, except the Macintosh keyboards and mouse. The Macintosh SE will accept any keyboard and mouse that connect to the new Apple DeskTop Bus™.

Internal Features

New or improved internal features include:

- 1 megabyte of RAM on repositioned slanted Single Inline Memory Modules (SIMMs)
- New 256K-byte ROM with modifications for support of the Apple DeskTop Bus and improved support of the Small Computer System Interface (SCSI) and AppleTalk
- Choice of internal SCSI hard disk or second 800K floppy disk drive
- Higher capacity 80-watt, wide-input-range power supply
- Internal fan for cooling
- Improved hardware handshaking on the SCSI port
- Internal 96-pin Euro-DIN bus connector for internal expansion board or other I/O device (mounting holes provided)

- Swing-away logic board mounting to allow easy removal when an internal expansion board is installed
- Seven-year lithium battery for clock and ram cache

External Features

New external features include:

- Two Apple DeskTop Bus connectors that support the detached keyboard and mouse
- Snap-out door at the rear to support optional external I/O device

Connector Identification

Back Panel Connectors

The back panel of the Macintosh SE has seven installed ports, and a slot for the installation of an additional expansion port. The number beside the port name below corresponds to the numbered arrow in Figure 1.

- #1 Apple DeskTop Bus (mini DIN-4)
- #2 Apple DeskTop Bus (mini DIN-4)
- #3 External drive port (DB-19)
- #4 SCSI port (DB-25)
- #5 Printer port (mini DIN-8)
- #6 Modem port (mini DIN-8)
- #7 Sound port (RCA phono jack)
- #8 Slot for optional expansion port

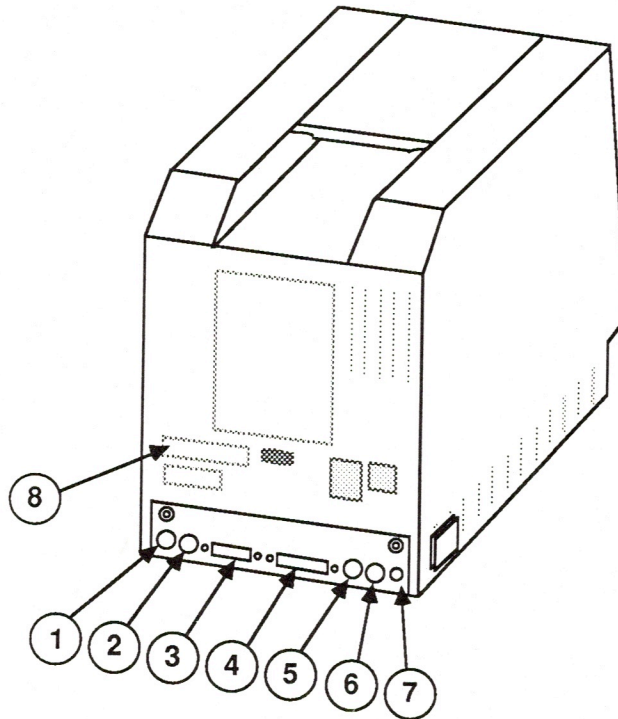


FIGURE 1

*Main Logic
Board
Connectors*

There are six connectors on the Macintosh SE logic board. In the list below, the number beside the connector name corresponds to the numbered arrow in Figure 2.

- #1 Power connector
- #2 Connector for lower internal 800K drive
- #3 Connector for upper internal 800K drive
- #4 Internal hard disk SCSI 50-pin ribbon cable connector
- #5 Speaker connector
- #6 96-pin Euro-DIN expansion connector

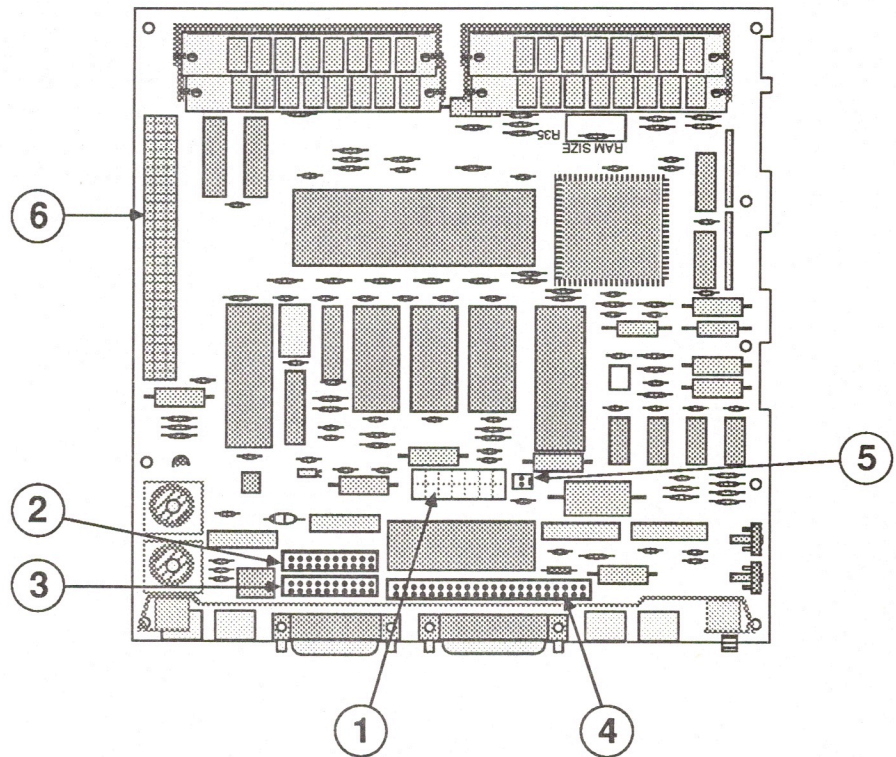


FIGURE 2

...Continued on next page

Internal Expansion Connector

The 96-pin connector on the logic board may be used in either of two ways:

- To attach a third-party co-processor board directly to the logic board via a right-angle connector. The co-processor board (measuring about 4 X 8 inches) would lie above and parallel to the logic board, supported by standoffs which may be installed in the logic board holes provided for that purpose.
- To attach a cable which is then routed to an external I/O device. From the connector on the logic board, the cable is routed up through the forward hole in the bottom of the metal chassis, through the mounting bracket on the rear of the chassis, and out through the snap-out accessory door on the rear of the case. (Remove the rear accessory door from inside the case.)

□ THEORY OF OPERATION

Introduction

The Macintosh SE has eight basic functional units:

- Main logic board
- Power supply
- Analog board
- Internal 800 disk drive(s)
- Internal hard disk (optional)
- Video board
- Video display (CRT)
- Apple DeskTop Bus keyboard and mouse

"Module-swapping," or repair by replacement of faulty modules, is much faster if you have a basic understanding of the function of each module in the unit. If you know what each module does when it is functioning normally, you can more easily decide which module of a unit is at fault when a particular function is missing or degraded. This is called "logical troubleshooting." The following section describes the Macintosh SE modules and the functions they perform.

Main Logic Board

The Macintosh SE main logic board, the heart of the system, contains the components described below:

CPU

The Central Processing Unit (CPU), a 68000 microprocessor, gets instructions from memory, translates them, and carries them out. It communicates with all components on the logic board.

SIMMs

The Macintosh SE dynamic RAM (Random Access Memory) is installed on 150-nanosecond Single Inline Memory Modules (SIMMs). Each SIMM is a small printed circuit card with eight surface-mounted ICs. The logic board has four sockets for SIMMs. The Macintosh SE comes with four 256K SIMMs installed.

ROM

The two ROM (Read Only Memory) chips contain the operating code for the 68000. The Macintosh SE ROM supports the Apple DeskTop Bus and gives improved support of SCSI and AppleTalk. The ROM chips, located at positions D6 and D7 on the logic board, are socketed and may be replaced by the technician.

*IWM
Disk
Controller*

The Macintosh SE uses 3.5-inch micro-floppy disk drives that operate under the Group Code Recording (GCR) disk format. The IWM chip, a self-contained disk controller on one IC, supports both the internal and external disk drives. The IWM simplifies the micro-processor's task of reading from and writing to the disk drives. The IWM, located at position D8 on the logic board, is socketed and may be replaced by the technician.

*Serial
Communications
Controller*

The Serial Communications Controller (SCC) handles information sent to and received from the serial ports on the back of the machine.

*Versatile
Interface
Adaptor*

The Versatile Interface Adaptor (VIA) converts serial data (from input devices) to parallel data, so that the logic board can interpret the information correctly.

Gate Array

The Macintosh SE incorporates gate array implementation of PAL (Programmable Array Logic) and other discrete logic devices. The Gate Array handles control and synchronizing functions for the main logic board.

Oscillator

The Oscillator, or timing device, generates the master clock pulse, which is broken down into the various timing signals needed by the ICs on the logic board.

Battery

The single long-life lithium battery provides power to the clock and calendar.

Sound Chip

The sound chip supports the internal speaker connector and the external sound jack.

SCSI Bus

The Apple SCSI manager supports up to seven daisy-chained SCSI devices.

*Apple
DeskTop
Bus*

The Apple DeskTop Bus is a method and protocol for connecting computers with human input devices. The Macintosh SE controls the flow of data to connected devices by issuing commands through the Apple DeskTop Bus.

Power Supply

The power supply is attached to the bottom half of the analog board. This is where AC voltage is converted to DC voltage for use by the entire system. The power supply operates on standard line voltage and outputs various DC voltages, which are used by the logic board, the video display, and by some peripheral devices.

Analog Board

The analog board contains circuits for both horizontal and vertical signals that are fed to the CRT. The flyback transformer on the analog board delivers high voltage directly to the CRT through the anode connector.

CRT and Video Board

The Cathode Ray Tube (CRT) provides the high resolution video display. The anode of the CRT receives high voltage from the flyback transformer on the analog board. The analog board also supplies the voltages and signals to the neck and yoke of the CRT that enable the CRT to create the video display. There is a separate video board on the neck of the CRT that provides video amplification and overvoltage protection.

800K Disk Drive(s)

The internal 800K disk drive (or drives) connects to the main logic board through two internally installed connectors. An external 800K drive may be connected to the disk drive port on the back of the logic board. The flow of data between the logic board and the disk drives is channeled through the IWM disk controller, which controls reading and writing operations.

SCSI Hard Disk

The optional hard disk connects to the logic board through the internal SCSI connector. Other SCSI devices may be daisy-chained to the Macintosh SE through the external SCSI port. The SCSI bus on the logic board will support a total of seven SCSI devices.

Apple DeskTop Bus Keyboard and Mouse

The keyboard connects to the Apple DeskTop Bus (ADB) port on the Macintosh SE. The mouse connects to the keyboard or to the other ADB port on the Macintosh SE. All devices made for the Apple DeskTop Bus have a microprocessor that makes them intelligent devices. All Apple DeskTop Bus devices communicate with the logic board via a mini DIN-4 connector. All except the mouse have ports for daisy-chaining other ADB devices. The mouse must be the last device in the chain because it has no port.

□ CARE AND HANDLING

The Macintosh SE is small enough to be somewhat portable. However, it does contain a CRT (picture tube) and may also contain a hard disk. The CRT may implode if cracked. The optional hard disk is a mechanical device with moving parts. Rough handling such as jarring or bumping, especially while the hard disk is running, can result in a mechanical failure or damage to the information stored on the hard disk. **Careless handling accounts for more drive failures than all other factors combined.**

With these facts in mind, always be sure to:

- Leave the Macintosh SE and the CRT and hard disk drive modules in the shipping containers until use.
- Use the shipping containers and packing materials when transporting the Macintosh SE or modules.
- Place the Macintosh SE on a protective padded surface before beginning any repair procedure.
- Never move the Macintosh SE during power-down. After the power is turned off, the hard disk will slow down and the heads will land within 15 seconds. Any jolts to the drive during power-down may cause the heads to crash into the media surfaces.
- Never drop a Macintosh SE. Even a drop of one inch to a hard surface could cause implosion of the CRT and/or a hard disk drive failure.

□ SAFETY PRECAUTIONS

The Macintosh SE, with its built-in video monitor, is harmless as long as you're just watching the display. Removing the cover, however, exposes you to the high-voltage Cathode-Ray Tube (CRT)—the picture tube. The following precautions must be taken to ensure your safety, especially when live adjustments of the monitor are required.

Safe Electrical Setup

- **Be sure your outlet is correctly wired and properly grounded.**

Polarity and ground testers are available from most electronics stores. Test all outlets in your service shop before working on **any** electrical equipment. If you have any doubts about your building's wiring, consult a qualified electrician.

- **Never use an adaptor plug to connect a monitor's three-prong power plug to a two-prong wall outlet.**

Adaptors defeat the ground pin, which is a safety feature.

- **Use an isolation transformer between the monitor and the outlet when performing live adjustments.**

Order an isolation transformer from your electronics distributor, and make it a practice to use it whenever you are working with **any** charged monitor or other powered system under test. An isolation transformer isolates the circuitry of the system under test from the power company's circuitry, thus reducing the likelihood of a fatal shock should you simultaneously contact high voltage and anything else that is earth-grounded.

Do not connect more equipment to the transformer than the wattage capacity of the transformer will bear. (It is usually best to connect only one piece of equipment at a time.) We recommend an isolation transformer with a minimum wattage capacity of 500 VA, with grounded three-prong cord and receptacle. Two such transformers, available from many electronics stores and distributors, are listed below:

Triad N-57M

Stancor GIS 500

CRT Safety Rules

- **Do not work on a monitor alone.**

In case of an accident, it could save your life to have someone else nearby. Apple recommends that your staff be trained in Cardio-Pulmonary Resuscitation (CPR).

- **Remove rings, wristwatches, bracelets, hanging necklaces, and other jewelry before performing repairs on a monitor.**

Metal jewelry is an excellent conductor of electricity. Removing jewelry will reduce the possibility of electric shock.

- **Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments.**

Grounding wriststraps, heelstraps, and mats are used to protect sensitive components from the damaging effects of electrostatic discharge from your own body or clothing. Even though they contain a one-megohm resistor and are designed to conduct only small electrical charges, we recommend that they be used **only** when working on "dead" (uncharged) equipment.

- **Wear safety goggles when working with a CRT.**

The CRT contains a high vacuum. If cracked or broken, it can implode (collapse into itself, then explode). To protect your eyes from serious injury, always wear safety goggles when working on or near a CRT, and be careful of other people in the area.

- **Disconnect the AC power cord before working on a monitor.**

Certain parts of a monitor chassis are **hot** (electrified) when the monitor is plugged in. Except when you **must** have the power on (for example, when making live adjustments), **never** work on a plugged-in monitor.

- **Keep one hand in your pocket or behind your back when working on a live monitor.**

This reduces the risk of current passing through your heart, should you accidentally contact high voltage.

- **Always discharge the anode before touching anything inside the Macintosh SE.**

The Macintosh SE has a bleeder resistor on the anode that drains off the charge when the power is turned off. **However, ensure your safety in the event that the resistor has failed and the anode is still fully charged, you must perform the discharge procedure before working inside the Macintosh SE.**

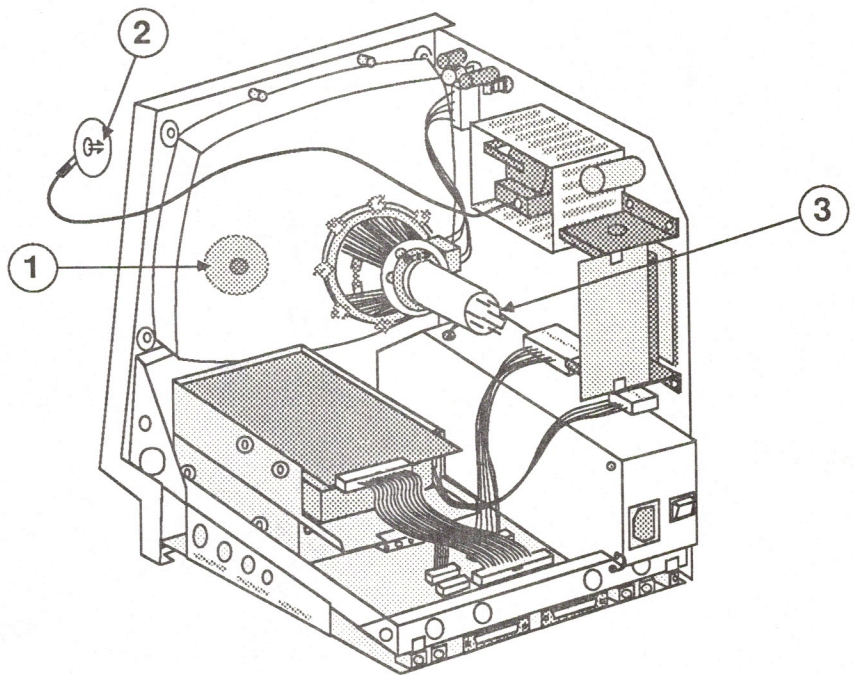


FIGURE 3

- **Never touch the anode connector or the anode aperture.**

Normally the anode aperture (Figure 3, #1) has a connector plugged into it (Figure 3, #2). When a CRT is replaced, the anode connector is removed, exposing the anode. If the bleeder resistor fails, the anode can retain a charge of several thousand volts (even when power is off), and can regain some charge even after it has been discharged.

- **Do not pick up or handle a CRT by its neck.**

To prevent an implosion, you should take every precaution against breaking the tube, especially at the neck (Figure 3, #3), where the tube is the thinnest. The neck is the part most likely to be sucked into the tube and expelled again should the tube implode.

Live Adjustment Rules

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Macintosh SE CRT:

- The yoke wires (Figure 4, #1)
- The anode connector (Figure 4, #2)
- The anode wire (Figure 4, #3)
- The flyback transformer (Figure 4, #4)

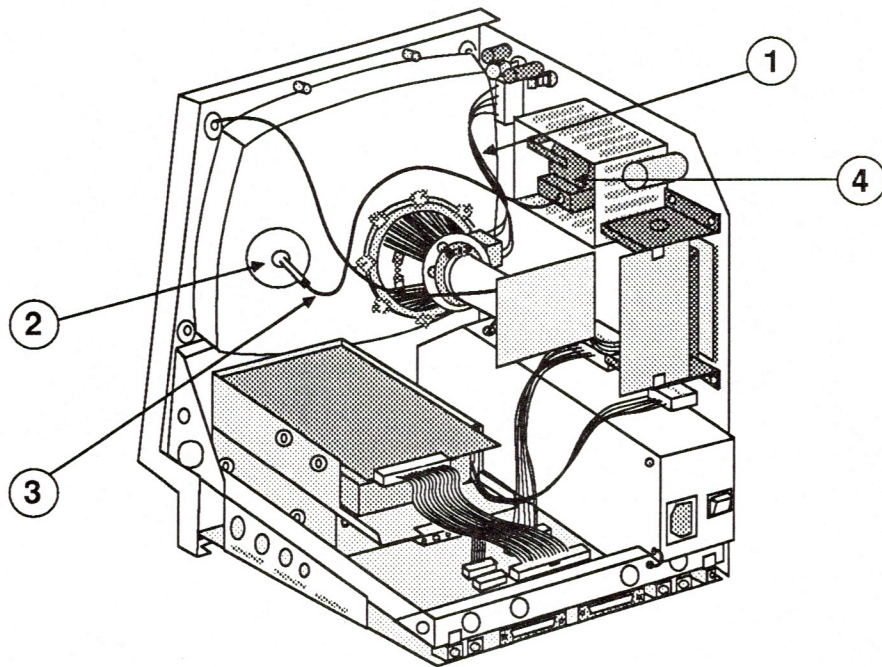


FIGURE 4

WARNING: *Serious injury could result if you touch any of these components with the power on.*

❑ DISPOSING OF THE MACINTOSH SE CRT

Remember that a CRT can implode unless devacuumed. Putting a defunct CRT into a trash receptacle without devacuuming it can endanger other people.

Materials Required

Thick cardboard box large enough to conceal the CRT
Large, sharp diagonal cutters
Large pliers
Duct tape
Safety goggles
Gardening gloves
12" x 12" piece of cloth or heavy paper

Devacuuming the CRT

1. Put on safety goggles.
2. Cut or drill a hole in the side of the box about six inches from the bottom, just large enough to insert the very tip of the CRT neck through.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape the box flaps down with the duct tape (Figure 5).

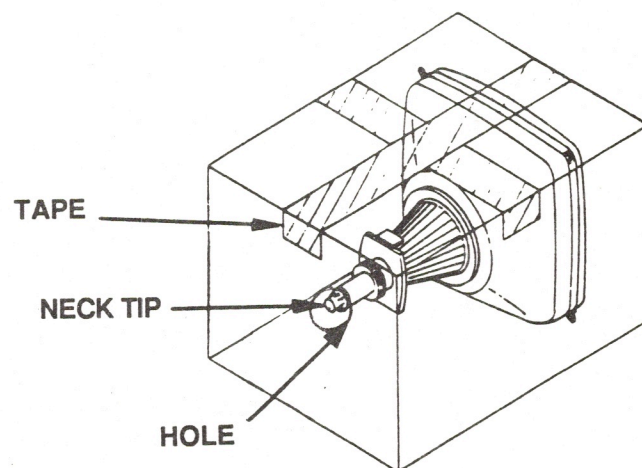


FIGURE 5

WARNING: Only the very tip of the CRT neck should be protruding through the hole in the box. The box must not have any other openings.

4. Put on the gloves.
5. Using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
6. Tape the piece of cloth or paper onto the box (Figure 6, #1) so that it forms a veil over the opening (Figure 6, #2), but allows your hand access to the tip of the CRT. The veil's purpose is to catch bits of glass that may fly during the following step.

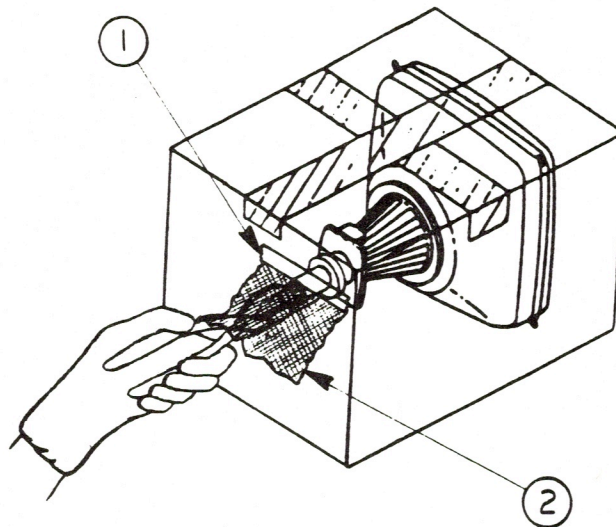


FIGURE 6

7. Make sure no one is standing nearby. Place the pliers under the veil and stand to one side and look away while you use the pliers to snip off the exposed tip of the CRT (see Figure 6).

WARNING: Do not look directly at the box when cutting off the tip!

Note: You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the inner space of the CRT is clearly visible through the opening created by the removed tip.

Macintosh SE

Section 2 – Take-Apart

□ CONTENTS

2.3	Cover
2.6	Discharging the Cathode Ray Tube (CRT)
2.9	Analog Board and Power Supply
2.16	Main Logic Board
2.20	SIMMs
2.21	SIMM Upgrades
2.22	Video Board
2.24	Cathode Ray Tube (CRT)
2.26	Internal SCSI Hard Disk Drive
2.28	Upper 800K Disk Drive
2.32	Lower 800K Disk Drive
2.34	Speaker and Front Bezel
2.36	Battery
2.39	Keyboard

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in the section.

□ COVER

Materials Required

Foam pad
Small flatblade screwdriver
15-inch Torx screwdriver
Pull-apart tool

CAUTION: *Electrostatic Discharge (ESD) can cause severe damage to sensitive microcircuits. The Macintosh SE logic board contains C-MOS components, among the most sensitive chips in use today. Printed circuit assemblies and ICs (integrated circuits, or "chips") in the Macintosh SE, especially those that are removable, must also be handled with extreme care. The Macintosh SE has two removable ROMs and four removable printed circuit assemblies (SIMMs), which contain the RAM memory. The C-MOS chips, ROMs, and SIMMs are very susceptible to ESD damage. To prevent ESD damage to the Macintosh SE components, follow the precautions outlined for ESD prevention in **You Oughta Know**.*

Remove

Remove the cover of the Macintosh SE as follows:

1. Place the Macintosh SE on the foam pad in an area where you will have ample room to remove the cover. Don't put it under shelves containing objects that could fall on the CRT and break it.

Note: Be especially careful when handling a Macintosh SE with an internal hard disk. Read "Care and Handling" in the Basics section before continuing.

2. Turn off the power and disconnect the power cord.
3. Disconnect the keyboard and mouse cables and all other peripheral cables from the back of the Macintosh SE.

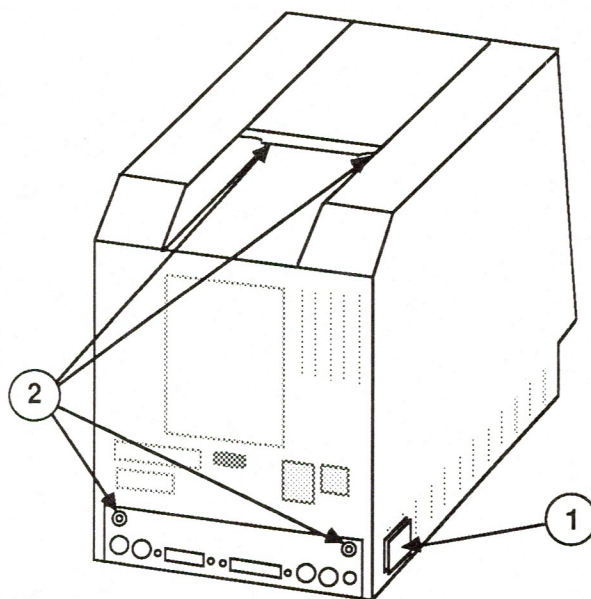


FIGURE 1

4. If a reset/interrupt switch (Figure 1, #1) is present, pry it off with a small flatblade screwdriver.
5. Place the Macintosh SE face down on the pad.
6. Use the Torx screwdriver to remove the four case screws (Figure 1, #2).
7. Carefully lift up the cover and set it out of the way. If the cover is difficult to remove, use the pull-apart tool. (To prevent cosmetic damage to the cover and bezel, do not use a screwdriver to pry off the cover.)
8. Remove the insulating paper shroud from the bottom of the Macintosh SE.

Replace

Replace the cover as follows:

1. Place the Macintosh SE face down on the foam pad.
2. Replace the insulating paper shroud over the bottom of the Macintosh SE.
3. Slide the cover over the chassis and fit it into the front bezel, making sure the video ground cable (Figure 2, #1) is out of the way of the case screw holder (Figure 2, #2).

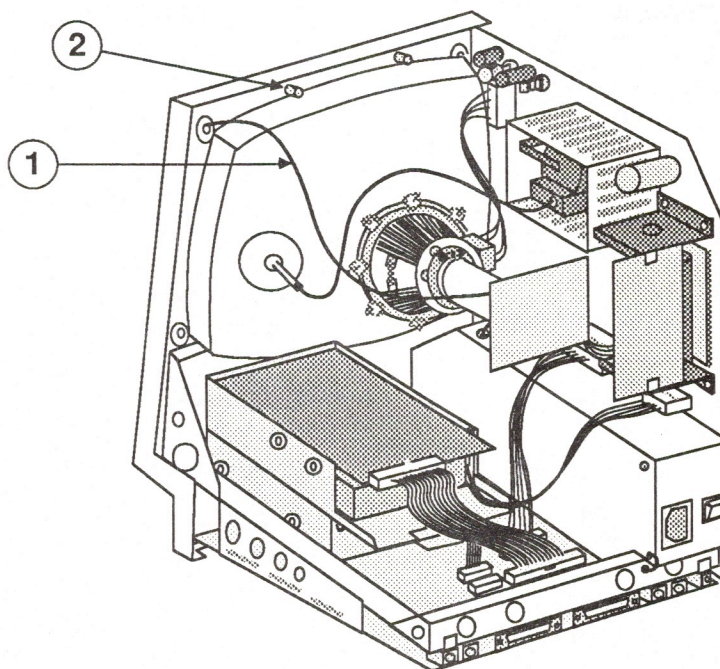


FIGURE 2

4. Reinstall the four case screws (Figure 1, #2).
5. Reinstall the reset/interrupt switch (Figure 1, #1).

❑ DISCHARGING THE CATHODE RAY TUBE (CRT)

Materials Required

Safety goggles
Foam pad (ungrounded)
CRT discharge tool
Needlenose pliers
Alligator lead

Discharge Procedure

The Macintosh SE CRT is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. **Nevertheless, you must follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.**

To discharge the Macintosh SE CRT:

1. **If you have not already done so, read the safety precautions in the Basics section before you proceed!**

WARNING: To prevent serious injury, do not touch the yoke wires (Figure 3, #1), the anode wire (Figure 3, #2), the anode connector (Figure 3, #3), or the flyback transformer (Figure 3, #4).

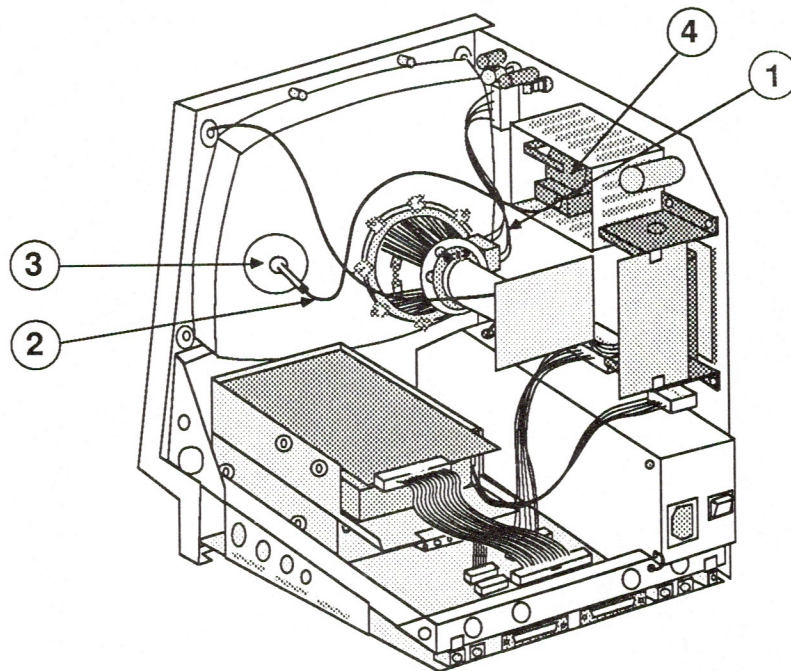


FIGURE 3

2. Remove any metal jewelry. If you are wearing a grounding wriststrap, remove it. Put on the safety goggles.
3. Remove the cover.
4. Set the monitor upright on the ungrounded foam pad, with the back facing you.

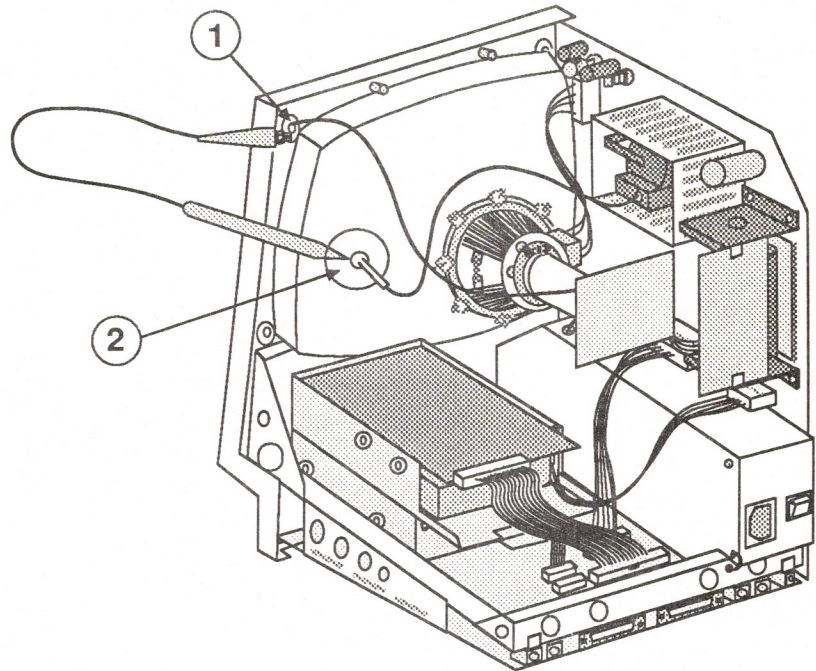


FIGURE 4

5. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (Figure 4, #1).

CAUTION: Discharge the anode to the metal part of the ground lug displayed in Figure 4, #1. Failure to do so will damage the main logic board and/or the analog board.

6. Put one hand behind your back and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT. This is to prevent you from becoming a path for current should your hand slip and touch the metal part of the discharge tool. While discharging the CRT, grasp only the insulated handle of the discharge tool.

7. Hold the CRT discharge tool to the tube surface, and insert it under the anode cap (Figure 4, #2) until it touches the anode ring.

8. Remove the CRT discharge tool from under the anode cap. To be sure the CRT is discharged, repeat step 7.
9. Remove the alligator clip from the ground lug. Set the tool aside where it will be out of the way.
10. For some of the following procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode ring at the center. Look at the metal connector in the center of the cap and notice how it is clipped into the CRT. Use the needlenose pliers to compress the two prongs on the clip to free it from the CRT, and lift it off the tube.

Note: A secondary charge can build up over a period of time, even after you have discharged the CRT. If repairs are not finished within 30 minutes, the anode should be discharged again. Or, to ensure that any residual charge is dissipated during the service procedure, establish a path for anode current to ground by fastening one end of an alligator lead to the metal ground lug and connecting the other end to the anode aperture.

□ ANALOG BOARD AND POWER SUPPLY

Materials Required

Grounded workbench pad and wriststrap
Small Phillips screwdriver

Remove

To remove the analog board and power supply:

1. Remove the cover and discharge the CRT.
2. Remove the anode cap (Figure 5, #1).

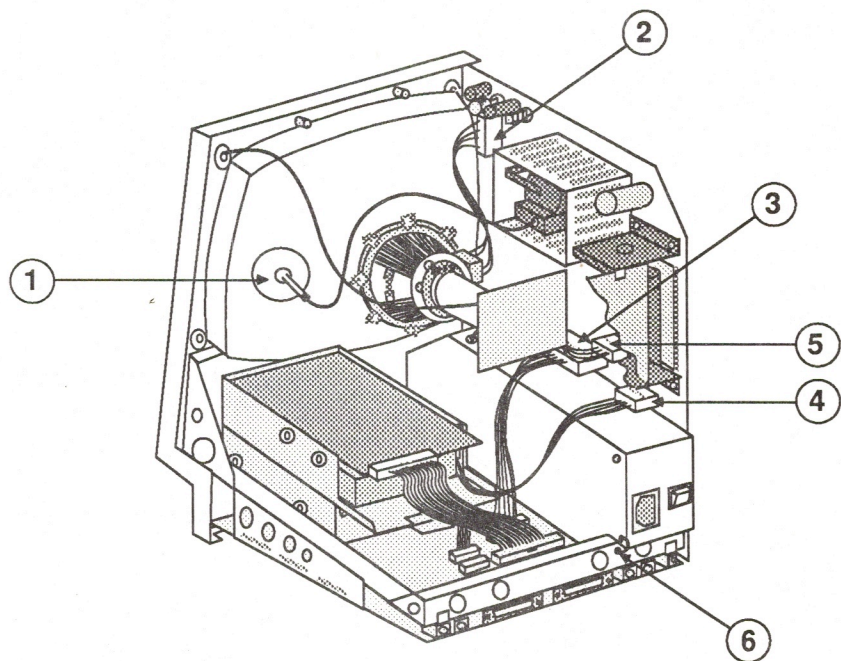


FIGURE 5

3. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
4. Remove the following cables from the analog board:
 - Yoke cable (Figure 5, #2). (First depress the tab.)
 - Main logic board cable (Figure 5, #3)
 - Hard disk power cable, if present (Figure 5, #4)
 - Video board cable (Figure 5, #5)
5. Remove the screw holding the power supply ground wire to the chassis (Figure 5, #6).

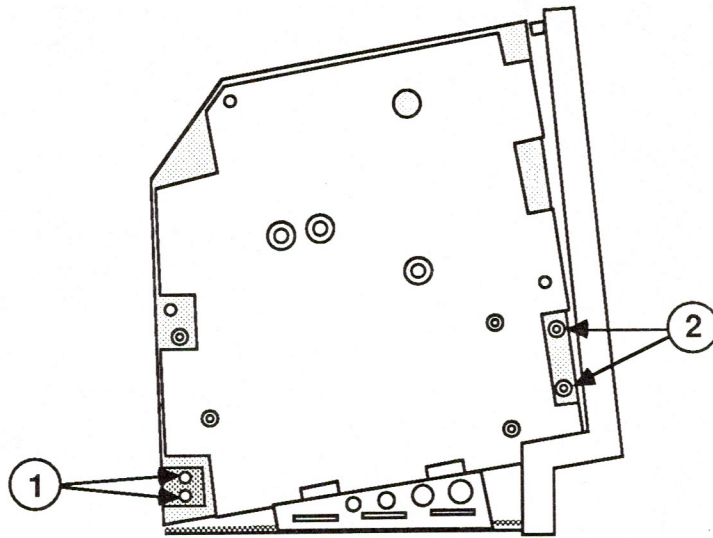


FIGURE 6

6. Using the small Phillips screwdriver, remove the two lower left analog board screws and the metal clip (Figure 6, #1).
7. Remove the two lower right analog board screws (Figure 6, #2).
8. Place the Macintosh SE face down on the grounded workbench pad.



FIGURE 7

9. Carefully move the analog board (with power supply attached) up and away from the chassis, taking care not to bump the CRT or the brightness control knob (Figure 7, #1) at the lower front of the analog board.

WARNING: Do not grasp the analog board by the fan.
Hold the analog board by the edges, using your fingertips.

10. Disconnect the power supply cable (Figure 7, #2) from the analog board.

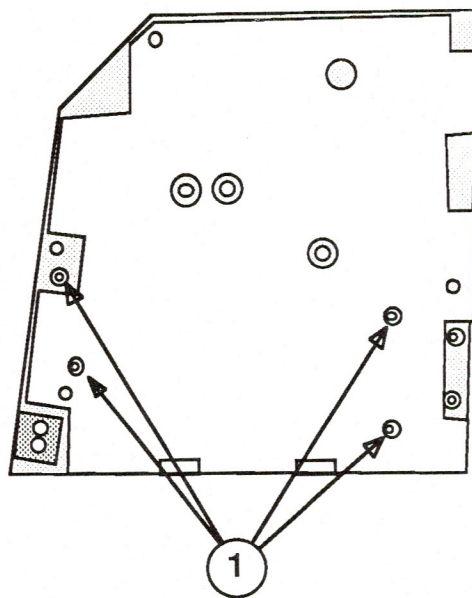


FIGURE 8

11. Place the board on the grounded workbench pad with the power supply down, and remove the four power supply screws (Figure 8, #1). Lift the board free.

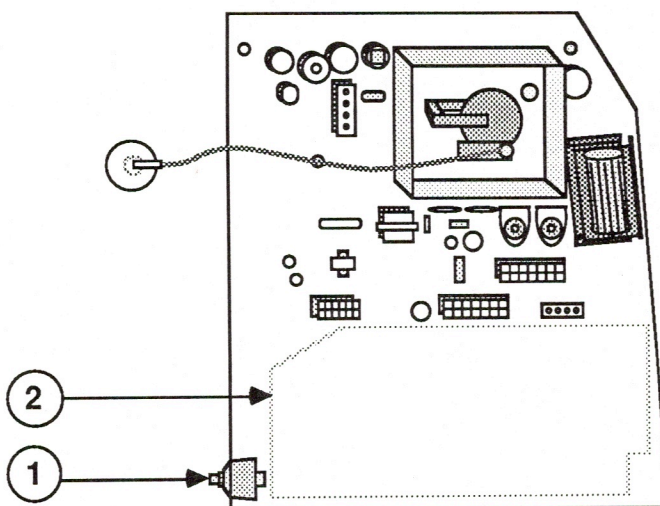


FIGURE 9

12. If you are returning the analog board to Apple, first remove the brightness knob (Figure 9, #1) and put the knob on the replacement analog board.

Replace

Replace the power supply and analog board as follows:

1. Place the power supply on the inside of the analog board, using the painted outline on the board as a guide (Figure 9, #2).
2. Holding the power supply in position, flip the analog board and power supply to a face-down position with the power supply underneath. **Do not grasp the analog board by the fan.**
3. Replace the four power supply screws (Figure 8, #1).

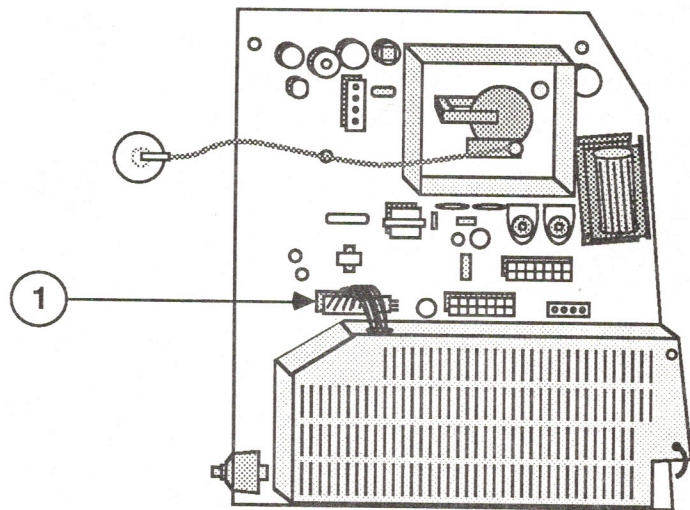


FIGURE 10

4. Reconnect the power supply cable (Figure 10, #1).

5. With the Macintosh SE face down on the grounded workbench pad, carefully place the analog board/power supply unit into the chassis, taking care not to bump the CRT or the brightness knob at the lower front of the analog board. It is easiest if you slide the corner with the brightness knob in first, then maneuver the power supply cage past the metal bracket at the back of the chassis. **Again, do not grasp the analog board by the fan.**

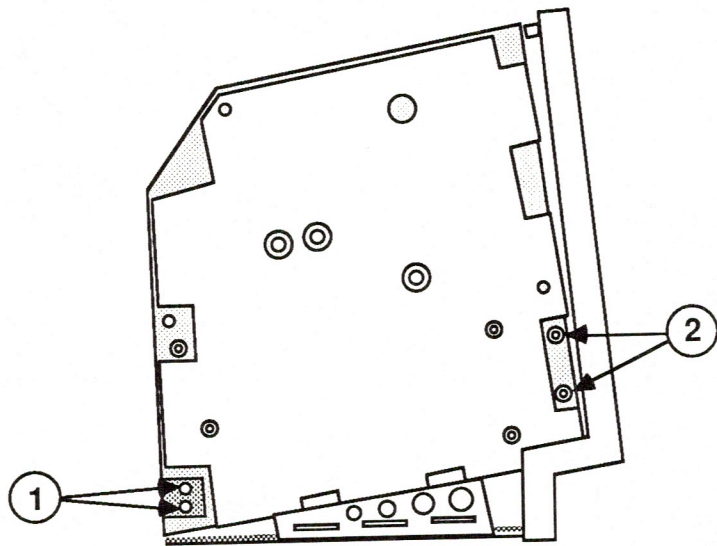


FIGURE 11

6. Replace the metal clip and the two lower left analog board screws (Figure 11, #1).
7. Replace the two lower right analog board screws (Figure 11, #2).

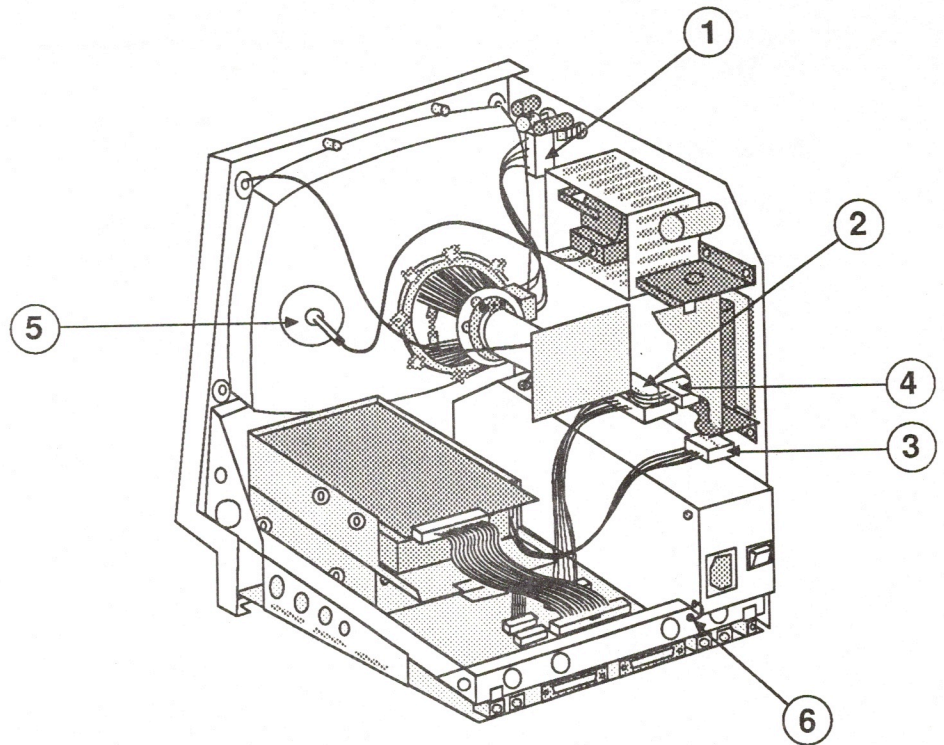


FIGURE 12

8. Reconnect the following cables to the analog board:

- Yoke cable (Figure 12, #1)
- Main logic cable (Figure 12, #2)
- Hard disk drive power cable (Figure 12, #3), if present
- Video board cable (Figure 12, #4)

9. Replace the anode cap (Figure 12, #5).

10. Replace the screw that secures the power supply ground wire to the chassis (Figure 12, #6).

11. Replace the cover.

❑ MAIN LOGIC BOARD

Materials Required

Grounded workbench pad and wriststrap
Small Phillips screwdriver

Remove

Follow these steps to remove the main logic board:

1. Remove the cover.
2. Discharge the CRT.
3. Place the Macintosh SE face down on the grounded workbench pad and put on your grounding wrist-strap. (Never do this until after the CRT has been discharged.)

CAUTION: In the following step, pull only on the pulltabs or on the connectors themselves, **not** on the cables.

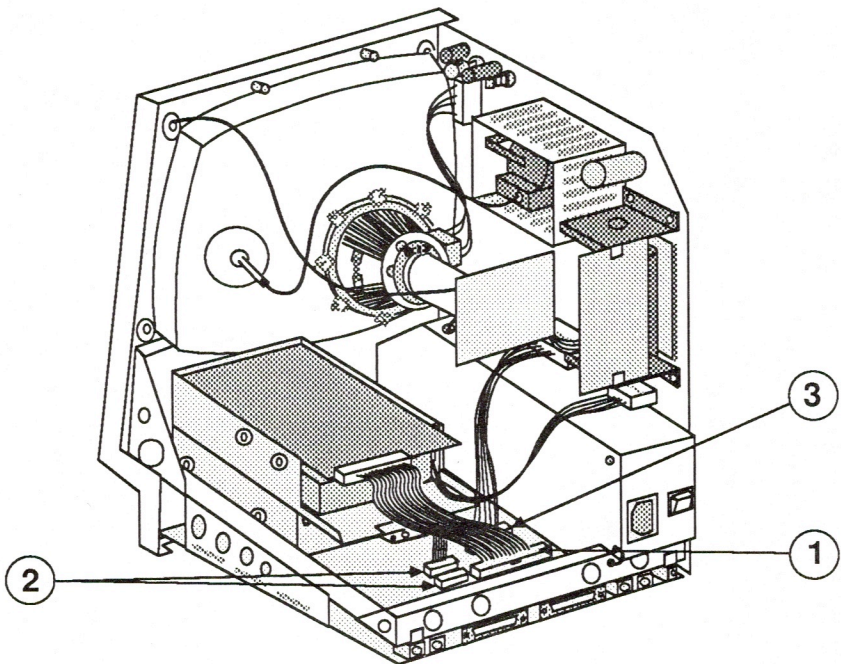


FIGURE 13

4. Remove these connectors from the main logic board:
 - Hard disk drive cable, if present (Figure 13, #1)
 - 800K disk drive cable(s) (Figure 13, #2)
 - Power supply cable (Figure 13, #3). (You must depress the holding clip on this connector before you can pull it out.)
5. Turn the Macintosh SE so that you are looking at the bottom of the main logic board. You will see that the right edge of the board is notched and the left edge is smooth.

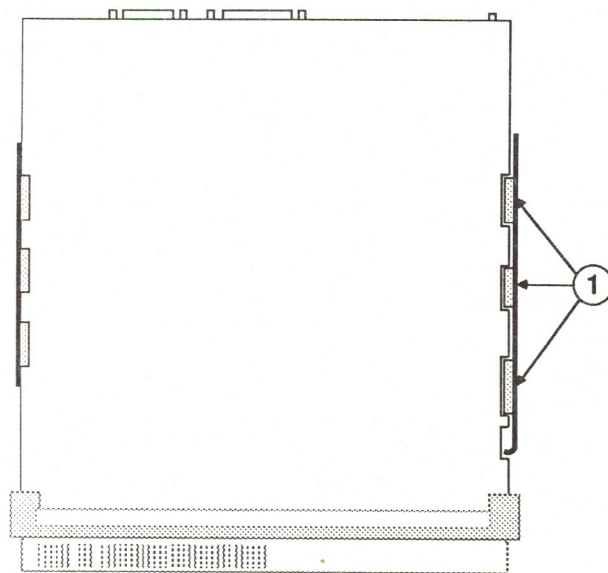


FIGURE 14

6. Holding the board by the edges, slide it up until the tabs on the right edge of the board exactly match the notches in the right metal bracket (Figure 14, #1).
7. Swing the right edge of the board free of the metal bracket and lift the board out of the metal chassis.

...Continued on next page

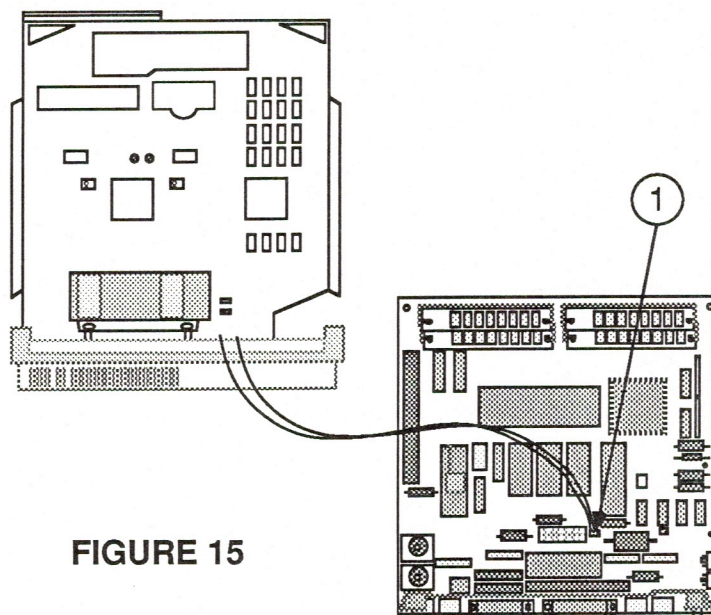


FIGURE 15

8. Set the main logic board down on the grounded workbench pad and disconnect the speaker cable from the board (Figure 15, #1).

Replace

Follow the steps below to replace the main logic board:

1. Reconnect the speaker cable (Figure 15, #1) to the main logic board.

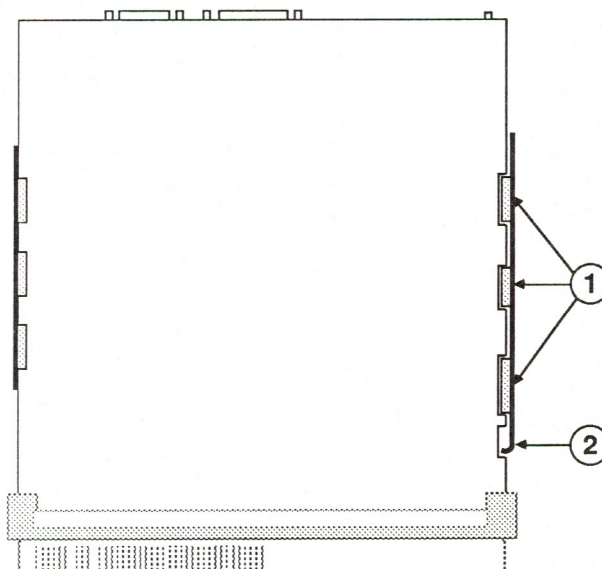


FIGURE 16

2. Fit the smooth left edge of the main logic board into the metal frame.
3. Exactly align the tabs on the right edge of the board with the notches on the right metal bracket (Figure 16, #1).
4. Settle the right edge of the board into the right metal bracket, then slide the board down until you hear it click into place. The lower right tab of the board should be flush against the curved "barrier" on the lower right edge of the metal bracket (Figure 16, #2).
5. Turn the Macintosh SE so that you can see the inside of the chassis.

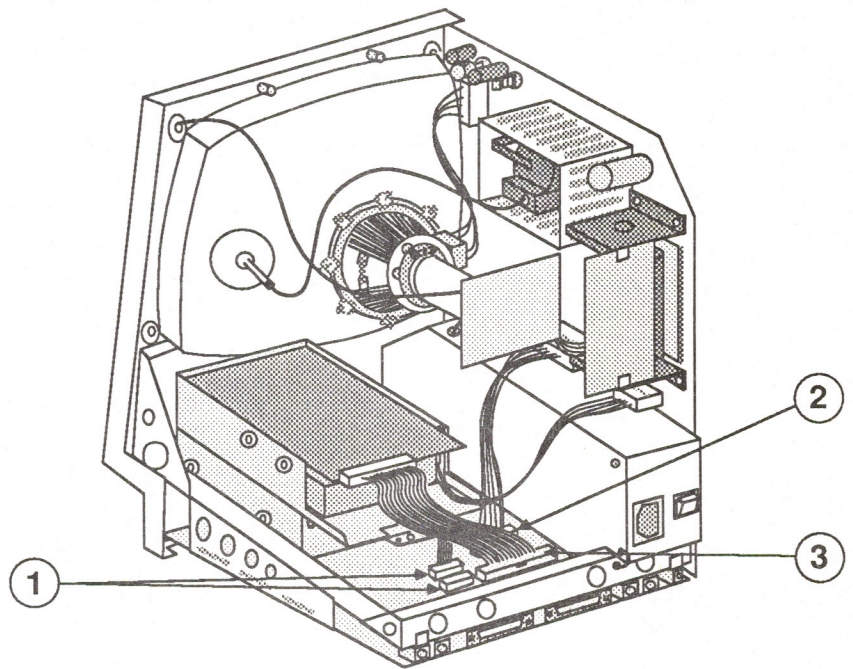


FIGURE 17

6. Reconnect the following to the main logic board:
 - 800K disk drive cable(s) (Figure 17, #1)
 - Power supply cable (Figure 17, #2)
 - Hard disk drive cable, if present (Figure 17, #3)
7. Replace the cover.

❑ SIMMs

The Macintosh SE comes with one megabyte of RAM installed on four 256K 150-nanosecond Single Inline Memory Modules (SIMMs). The replacement SIMMs are 120-nanosecond. (The 120-nanosecond and 150-nanosecond SIMMs are interchangeable in the Macintosh SE.)

Materials Required

Grounded workbench pad and wriststrap

Remove

Follow the steps below to remove a SIMM from the main logic board:

1. Remove the cover and discharge the CRT.
2. Put on your grounding wriststrap and place the Macintosh SE on the grounded workbench pad. (Never do this until after the CRT is discharged.)
3. Remove the main logic board.

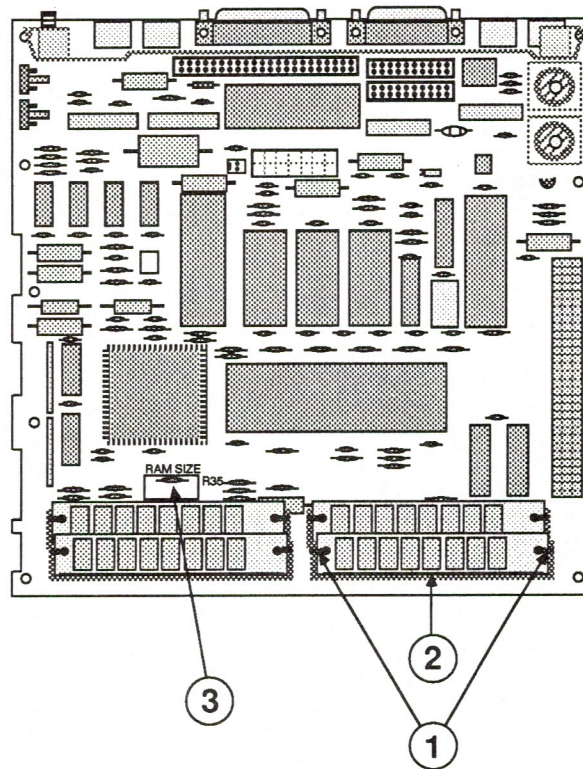


FIGURE 18

4. To remove a SIMM, push outward on the plastic holders (Figure 18, #1) at the ends of the module until you hear a click. Then lift out the module.

CAUTION: *SIMMs are very susceptible to ESD and skin acid damage. Handle only by the edges.*

Replace

Follow the steps below to replace a SIMM:

1. With the contacts (Figure 18, #2) on the SIMM pointing down, set the module into the connector at an angle (bottom forward).
2. Push back on the top corners of the module. You will hear a click when the module snaps into place.
3. Replace the main logic board.
4. Replace the cover.

□ SIMM UPGRADES

The Macintosh SE RAM may be expanded to 2.5 or 4 megabytes by removing either two or four 256K SIMMs, cutting out a resistor (R35), and installing two or four 1-megabyte SIMMs.

Locate the R35 resistor (Figure 18, #3) in the area labeled RAM SIZE. Using small diagonal cutters, clip the resistor off the board and discard it. (You do not need to desolder the leads from the board.)

For 2.5 megabytes: Install two 1-megabyte SIMMs in positions 1 and 2, leaving 256K SIMMs in positions 3 and 4.

For 4 megabytes: Install four 1-megabyte SIMMs.

❑ VIDEO BOARD

Materials Required

Grounded workbench pad and wriststrap
Torx screwdriver

Remove

Follow the steps below to remove the video board:

1. Remove the cover.
2. Discharge the CRT.

WARNING: Leave your safety goggles on for the remainder of this procedure.

3. Put on your grounding wriststrap and place the Macintosh SE on the grounded workbench pad. (Never do this until after the CRT has been discharged.)

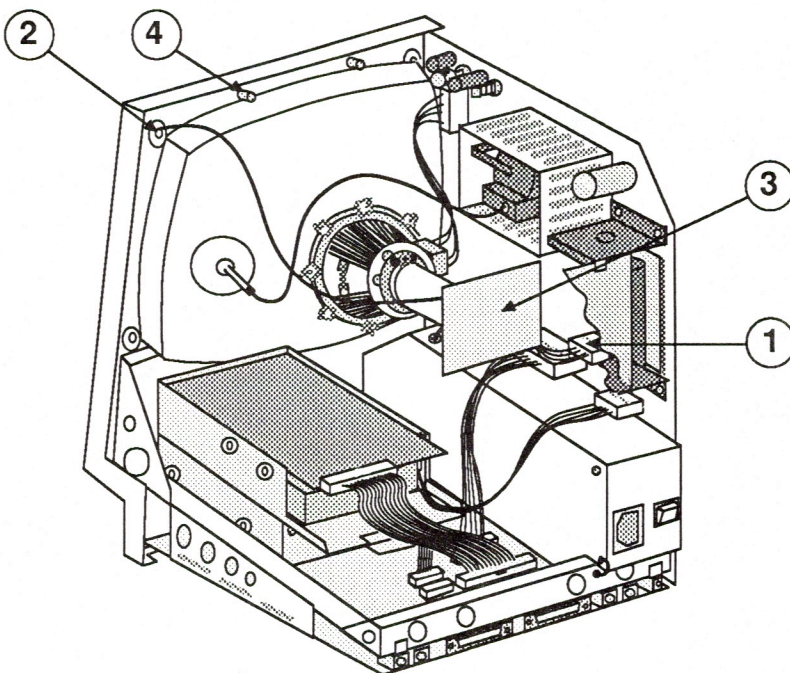


FIGURE 19

4. Disconnect the video board connector (Figure 19, #1) from the analog board.
5. Remove the Torx screw holding the video ground wire to the upper left CRT mounting bracket (Figure 19, #2).
6. Carefully pull the video board (Figure 19, #3) off the neck of the CRT.

Replace

Follow the steps below to replace the video board:

1. Reconnect the video board (Figure 19, #3) to the neck of the CRT. It fits only one way.
2. Place the video ground wire tab over the upper left CRT mounting bracket and replace the Torx screw (Figure 19, #2). Be sure the ground wire is routed away from the case screw holder (Figure 19, #4).
3. Reconnect the video board cable to the analog board (Figure 19, #1).
4. Replace the cover.

❑ CATHODE RAY TUBE (CRT)

Materials Required

Grounded workbench pad and wriststrap
Torx screwdriver

Remove

Follow the steps below to remove the CRT:

1. Remove the cover and discharge the CRT.

WARNING: Leave your safety goggles on for the remainder of this procedure.

2. Remove the anode cap.
3. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
4. Remove the analog board. (Do not remove the power supply from the analog board.)
5. Remove the video board.

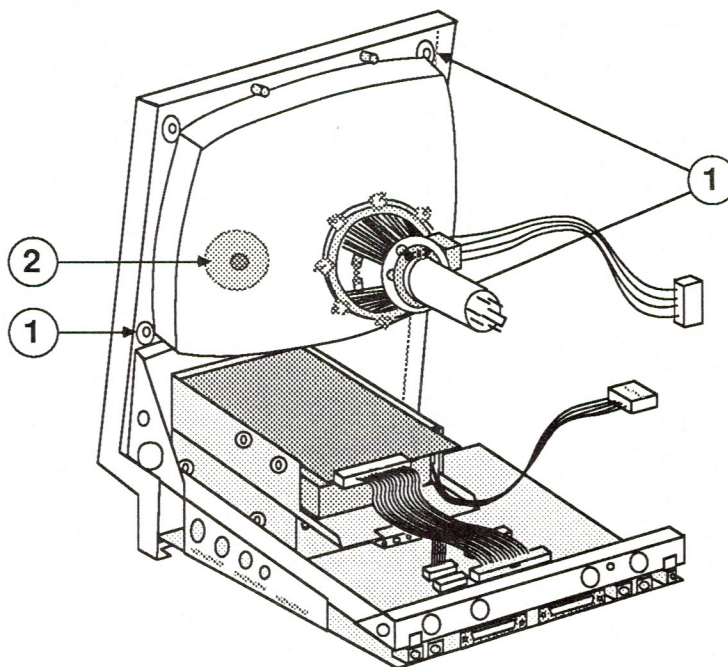


FIGURE 20

6. Using the Torx screwdriver, remove the three remaining mounting screws from the corners of the CRT (Figure 20, #1).
7. Lift the CRT free from the bezel.

Replace

Follow the steps below to replace the CRT:

1. Place the CRT face down in the bezel, with the anode aperture (Figure 20, #2) on the left, as shown.
2. Replace the three CRT mounting screws shown in Figure 20, #1.

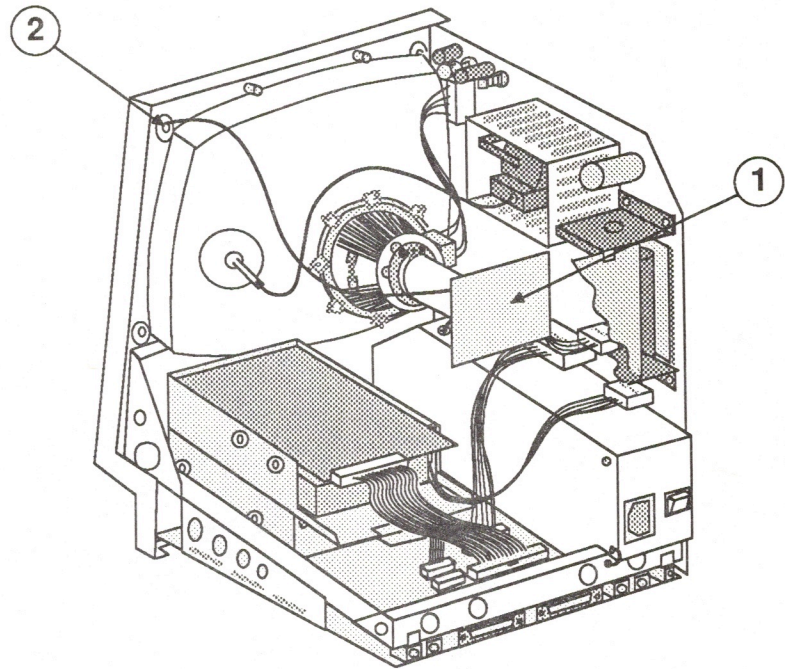


FIGURE 21

3. Replace the video board (Figure 21, #1).

Note: Directions for replacing the fourth CRT mounting screw (Figure 21, #2) are included in the video board procedure.

4. Replace the analog board/power supply.
5. Replace the cover.

□ INTERNAL SCSI HARD DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

Follow the steps below to remove the optional internal SCSI hard disk drive.

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)

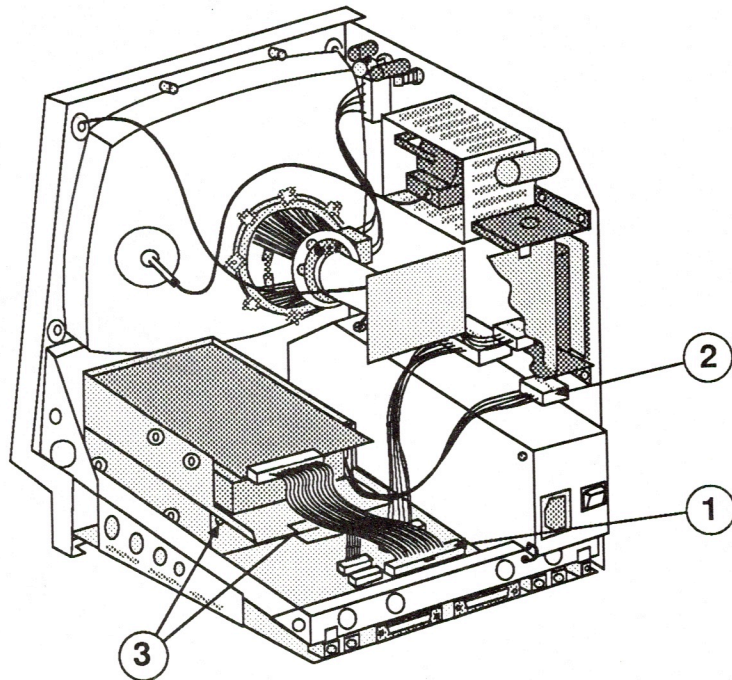


FIGURE 22

3. Disconnect the hard disk drive cable from the main logic board (Figure 22, #1).
4. Disconnect the hard disk drive power cable from the analog board (Figure 22, #2).

5. Remove the two Phillips screws that secure the hard disk drive housing to the lower drive housing (Figure 22, #3), and lift out the hard disk assembly.
6. Before returning the hard disk assembly to Apple, remove the 50-pin SCSI connector cable.

Replace

To replace the optional internal SCSI hard disk drive:

1. Replace the 50-pin SCSI connector cable on the hard disk assembly.
2. Slide the hard disk assembly over the lower drive so that the tabs on bottom of the hard drive housing mesh with the top holes on the lower drive housing.

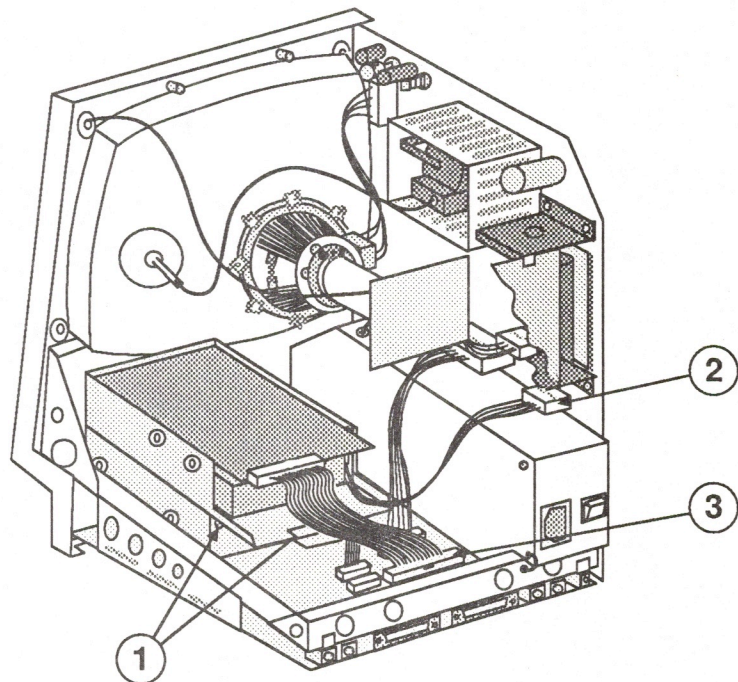


FIGURE 23

3. Replace the two screws that secure the hard disk housing to the lower drive housing (Figure 23, #1).
4. Reconnect the hard disk drive power supply cable to the analog board (Figure 23, #2).
5. Reconnect the drive cable to the main logic board (Figure 23, #3).
6. Replace the cover.

□ UPPER 800K DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

To remove the optional upper 800K drive:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)

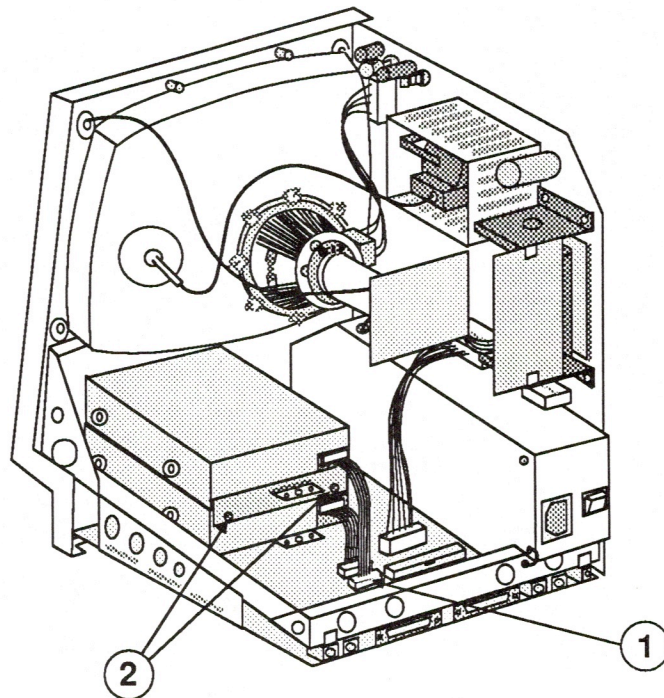


FIGURE 24

3. Disconnect the upper 800K disk drive cable from connector J7 on the main logic board (Figure 24, #1).
4. Remove the two screws (Figure 24, #2) from the metal bracket that holds the two drive housings together. Lift off the metal bracket.

5. Slide the upper 800K drive forward and lift it out.
6. Remove the four screws, two on each side of the metal drive housing, and remove the drive mechanism from the housing.

Note: If you are sending the drive mechanism back to Apple, place it in the shipping fixture that the replacement drive mechanism came in, and install a dummy packing diskette into the drive.

Replace

1. Remove the shipping fixture and the dummy packing diskette from the replacement 800K drive mechanism.
2. Place the drive mechanism into the metal housing and replace the four Phillips screws, two on each side (Figure 25, #1).

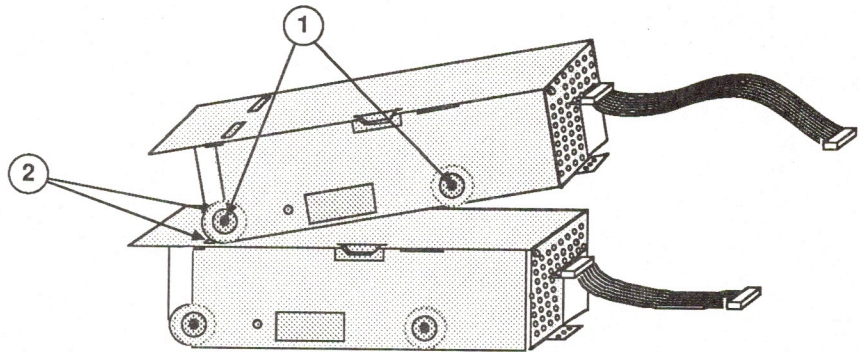


FIGURE 25

3. To place the upper drive into the chassis over the installed lower drive, slide the upper 800K drive forward then back over the lower 800K drive so that the tabs on the top of the lower drive housing mesh with the holes on the bottom of the upper drive housing (Figure 25, #2).

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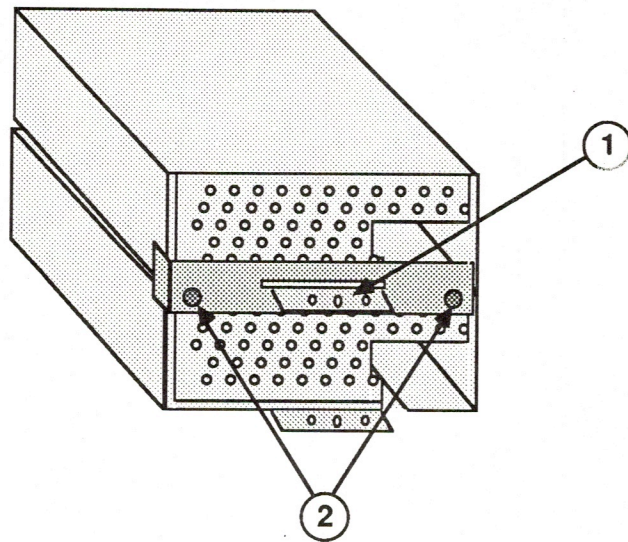


FIGURE 26

4. Place the metal bracket over the two drive housings so that the slot in the bracket (Figure 26, #1) fits over the tab on the upper housing.
5. Replace the two Phillips screws (Figure 26, #2) that secure the metal bracket to the lower 800K drive housing.

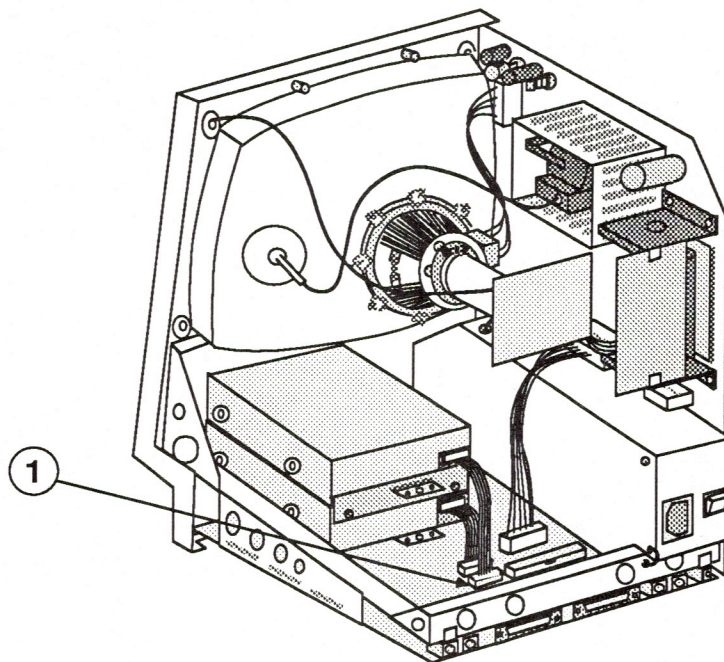


FIGURE 27

6. Reconnect the upper 800K disk drive cable to connector J7 on the main logic board (Figure 27, #1).

Note: You must use the longer of the two available **yellow-coded** 800K disk drive cables for the upper drive. The shorter cable will not reach to the main logic board. (The two cables are identical except for length.)

7. Replace the cover.

❑ LOWER 800K DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

To remove the lower 800K disk drive:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the hard disk drive or upper 800K drive, whichever is present.
4. Remove the main logic board.

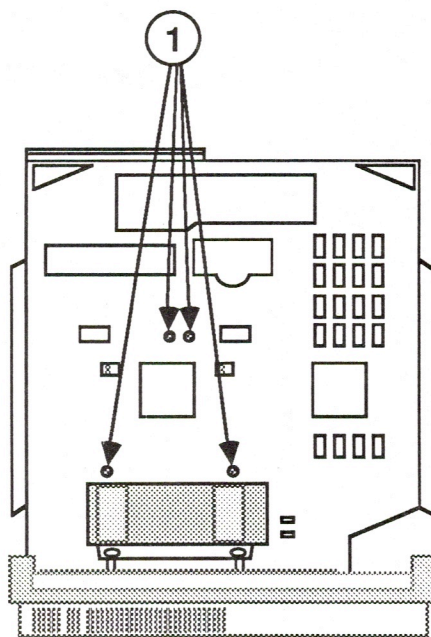


FIGURE 28

5. With the bottom of the Macintosh SE chassis facing you, remove the four Phillips screws (Figure 28, #1) that secure the lower 800K drive to the bottom of the metal chassis. Lift the drive free.

6. Remove the four screws, two on each side of the metal drive housing, and remove the drive mechanism from the housing.

Note: If you are sending the drive mechanism back to Apple, place it in the shipping fixture that the replacement drive mechanism came in, and install a dummy packing diskette into the drive.

Replace

1. Remove the shipping fixture and the dummy packing diskette from the replacement 800K drive mechanism.
2. Place the drive mechanism into the metal housing and replace the four Phillips screws, two on each side.

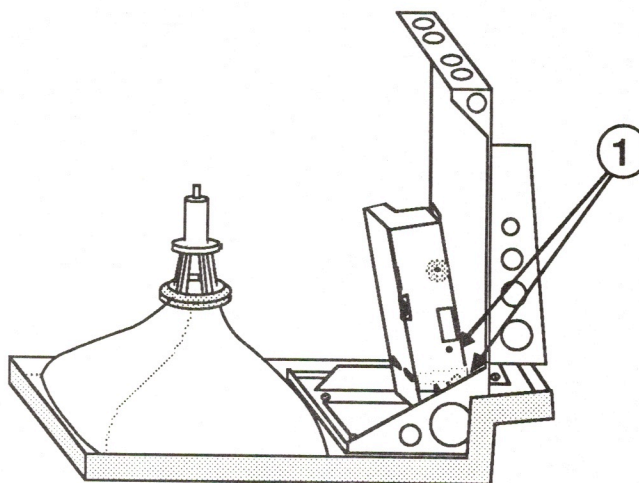


FIGURE 29

3. Place the drive into the chassis so that the tabs on the bottom of the metal drive housing fit into the holes provided in the chassis frame (Figure 29, #1).
4. Replace the four Phillips screws (Figure 28, #1) that secure the 800K drive to the bottom of the metal chassis.
5. Replace the main logic board.
6. Replace the hard disk or upper 800K drive.
7. Replace the cover.

□ SPEAKER AND FRONT BEZEL

Materials Required

Grounded workbench pad and wriststrap
Exacto knife
Soldering iron
Torx screwdriver

Remove

Follow the steps below to remove the speaker or bezel:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the main logic board.
4. Remove the analog board. (Do not remove the power supply from the analog board.)

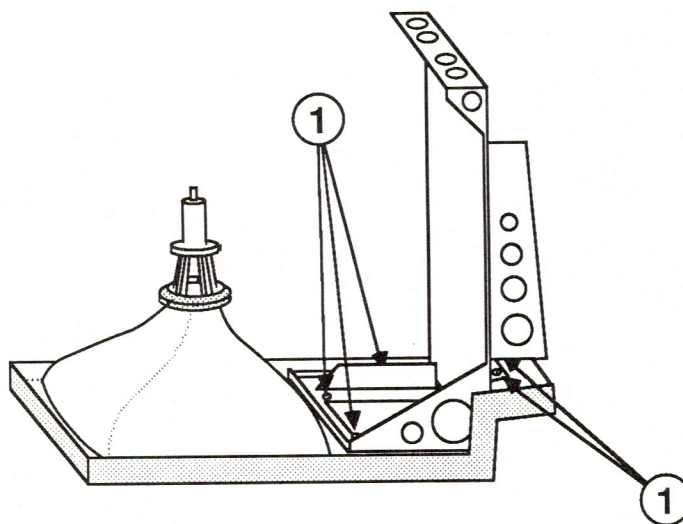


FIGURE 30

5. Remove the five Torx screws (Figure 30, #1) that secure the metal chassis to the bezel, and lift out the chassis, with disk drive(s) attached.

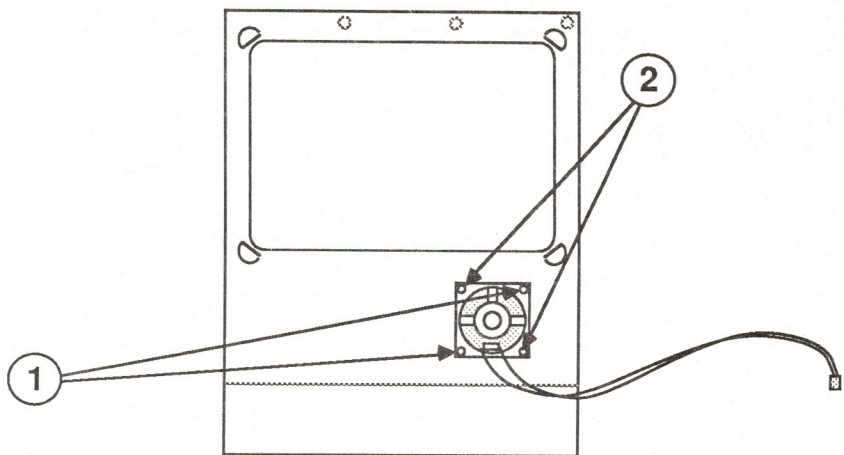


FIGURE 31

6. If you are replacing the speaker, use an exacto knife to cut away the melted plastic that secures two of the corners of the speaker to the front bezel (Figure 31, #1) and lift the speaker out.
7. If you are replacing the bezel, first remove the CRT.

Replace

Follow the steps below to replace the speaker or bezel:

1. Place the bezel face down on the grounded workbench pad.
2. Position the speaker in the bezel (see Figure 31).
3. Touch a heated soldering iron to the two previously unmelted plastic posts that now protrude through the corners of the speaker (Figure 31, #2). The plastic will spread as it melts, then harden, holding the speaker in place.
4. Replace the CRT, if you removed it.
5. Replace the metal chassis, with disk drive(s) attached, and fasten it to the bezel with the five Torx screws (Figure 30, #1).
6. Replace the analog board.
7. Replace the main logic board.
8. Replace the cover.

□ BATTERY

Introduction

Lithium thionyl chloride batteries, the type used in the Macintosh SE, have some potential for explosion if improperly handled. The following precautions should be taken when storing, handling, and disposing of lithium batteries.

- Lithium batteries should be stored in a designated, well-marked area with limited access.
- Apple's lithium batteries are sealed in individual zip-lock wrappers. Upon receipt, the batteries should be inspected for integrity of their wrappers, and should be stored in the same packaging in which they were received.
- Lithium batteries cannot be recharged and therefore will require disposal when "dead." In addition to its explosive potential, lithium is water-reactive **and must be disposed of as a hazardous waste**. Therefore, Apple recommends the following course of action:

After removing a "dead" battery from a board, clip off the lead wires and place the battery into the zip-lock wrapper and original packaging from which the replacement battery was taken. Mark the battery DEAD and return it to Apple, where it will be disposed of following EPA guidelines.

The Macintosh SE contains a single long-life lithium battery that should serve for the life of the product. However, if a battery does fail, replace it according to the following procedure.

Replacement Procedure

To replace the Macintosh SE battery:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the main logic board.
4. Place the main logic board on the grounded workbench pad.

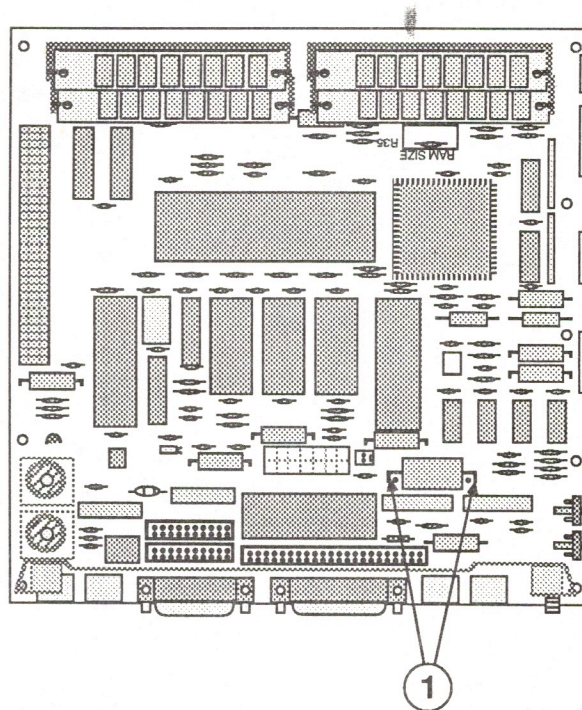


FIGURE 32

5. Using wire clippers, cut the leads (Figure 32, #1) at both ends of the battery to free it from the main logic board. Cut the leads as close to the logic board as you can without touching the board with the clippers.

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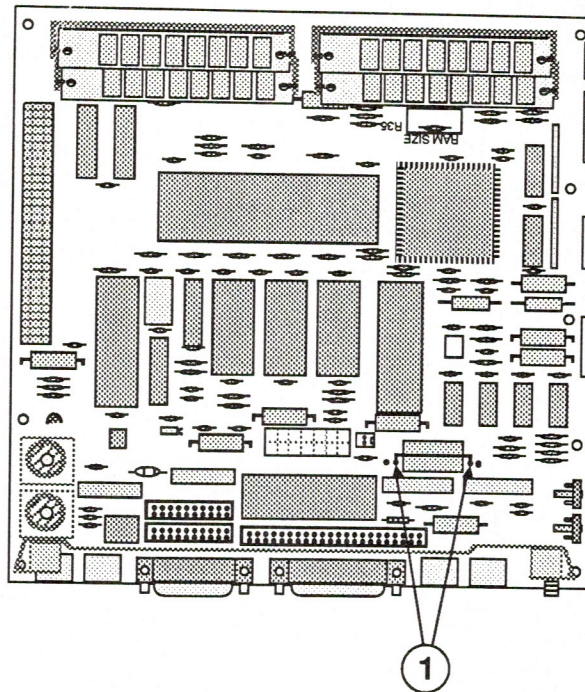


FIGURE 33

6. Orient the new battery so that the end marked "+" matches the "+" on the main logic board. Insert the battery leads into the extra set of mounting holes (Figure 33, #1) on the logic board (just inside the original mounting holes). Make sure the leads go all the way through the logic board to the other side.
7. Holding the battery in place, turn the logic board over and touch a heated soldering iron to the two new battery leads that are protruding through the inner mounting holes.

Note: It is not necessary to desolder the remains of the old leads from the outer mounting holes.

8. Replace the main logic board.
9. Replace the cover.
10. Trim off the leads of the old battery, package and label it as directed in the introduction to this procedure, and return it to Apple for proper disposal.

□ KEYBOARD

Exchanging the Keyboard

If you are exchanging the keyboard, **do not** remove the keyboard mechanism. Send in the entire unit for exchange (**without** the cable). Remove the keyboard mechanism **only** when you must replace a keyswitch.

Note: Various Apple DeskTop Bus keyboards may be used with the Macintosh SE. The procedures for opening other Apple DeskTop Bus keyboards are similar to the one below (for the Apple Keyboard).

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Removing the Keyboard Mechanism

To remove the keyboard mechanism:

1. Disconnect the keyboard from the Macintosh SE.
2. Remove the keyboard cable.
3. Place the keyboard on the grounded workbench pad and put on your grounding wriststrap.
4. Remove the three Phillips screws from the back of the keyboard and lift off the top plastic cover.

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5. Before you remove the mechanical assembly from the bottom case, notice how the small breakaway boards (with the Apple DeskTop Bus connectors) fit into the upper corners of the bottom case (Figure 34, #1).

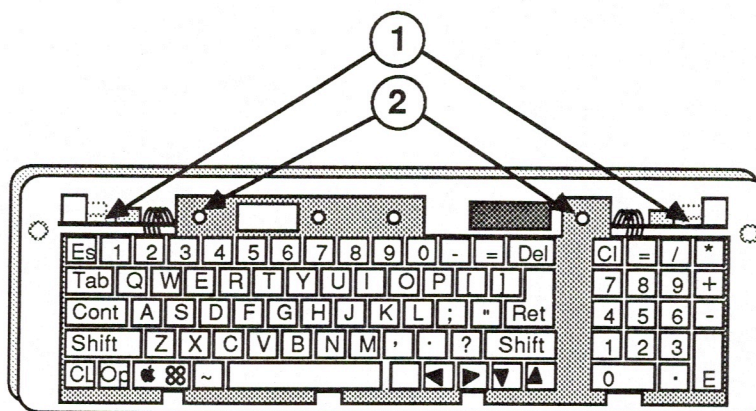


FIGURE 34

6. Lift the mechanical assembly out of the bottom case.
7. Use the replacement procedures for Apple DeskTop Bus keyboard keyswitches in *You Oughta Know*.

Replacing the Keyboard Mechanism

To replace the keyboard mechanism:

1. Place the mechanical assembly in the bottom case and slip the small breakaway boards into place vertically (Figure 34, #1).
2. Engage the top cover's teeth onto the front edge of the bottom cover, and fit the top cover's guide posts into the holes on the bottom cover (Figure 34, #2).
3. Hold the cover in place, turn the keyboard over, and install the three case screws.

Macintosh SE

Section 3 – Adjustments

□ CONTENTS

- 3.2 Yoke Adjustments
 - 3.2 Introduction
 - 3.2 Materials Required
 - 3.3 Tilt Adjustment
 - 3.3 Centering Ring Adjustment
- 3.4 Video Adjustments
 - 3.4 Introduction
 - 3.4 Materials Required
 - 3.5 Adjustment Procedures

□ YOKE ADJUSTMENTS

Introduction

In infrequent cases, you may need to adjust the yoke of the Macintosh SE after you replace the CRT. To see if the yoke needs adjusting, turn the power on and look at the CRT screen. If the picture is tilted, correct it using the tilt adjustment. If the picture is off center, use the centering rings adjustment.

Yoke adjustments are made while standing behind the Macintosh SE, so you must position a mirror so that you can see the screen. **Because of the high voltage danger, do not try to make live adjustments by facing the screen and reaching around the computer; you can't see what your hands are going to touch.**

Materials Required

Small Phillips screwdriver
Safety goggles
CRT discharge tool
Soft cloth or foam pad
Mirror
Exacto knife

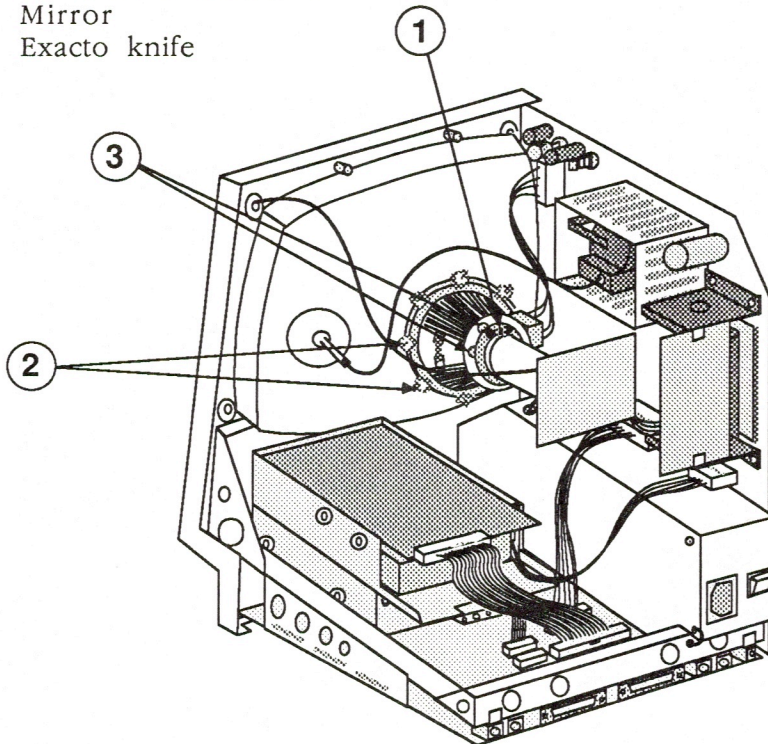


FIGURE 1

WARNING: Read the safety precautions in Section 1, Basics, before performing adjustments. Failure to follow the safety rules could result in serious injury.

Tilt Adjustment

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the computer with its back facing you and position the mirror so that the CRT screen is visible in the mirror.
4. Loosen the yoke clamp screw (Figure 1, #1) at the top of the CRT neck two or three turns.
5. Connect the power cord and turn the power on.
6. Put one hand behind your back and with your other hand grasp only the plastic spokes of the yoke collar (Figure 1, #2). Rotate the yoke until the top and bottom edges of the picture appear parallel with the top and bottom edges of the bezel.
7. Turn the power off, unplug the computer, and discharge the CRT again.
8. Hold the yoke collar in the position you just determined in Step 5 and carefully tighten the yoke clamp screw just enough so that the yoke cannot slip. Do not overtighten.
9. Replace the cover.
10. Connect the power cord and turn the power on to make sure the tilt adjustment is still correct.

Centering Ring Adjustment

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the Macintosh SE so that its back is facing you, and position the mirror so that the CRT screen is visible in the mirror.
4. Locate the two centering rings on the yoke assembly (Figure 1, #3). The adjustment of these rings determines whether the picture is centered or offset to one side.

Note: If a bonding material is holding these rings in place, break it using an exacto knife.

5. Connect the power cord and turn the power on.
6. Center the picture by first holding the front centering ring steady and moving the rear ring, then holding the rear ring steady and moving the front ring.
7. When the picture is perfectly straight and centered, turn the power off, remove the power cord, and again discharge the CRT.
8. Replace the cover.
9. Plug in the power cord, turn on the Macintosh SE, and view the screen to ensure that the centering adjustment is still correct.

□ VIDEO ADJUSTMENTS

Introduction

Video adjustments **may** be necessary whenever the CRT, the analog board, or the power supply is replaced.

Materials Required

Safety goggles
Alignment tool
Mirror
Ruler

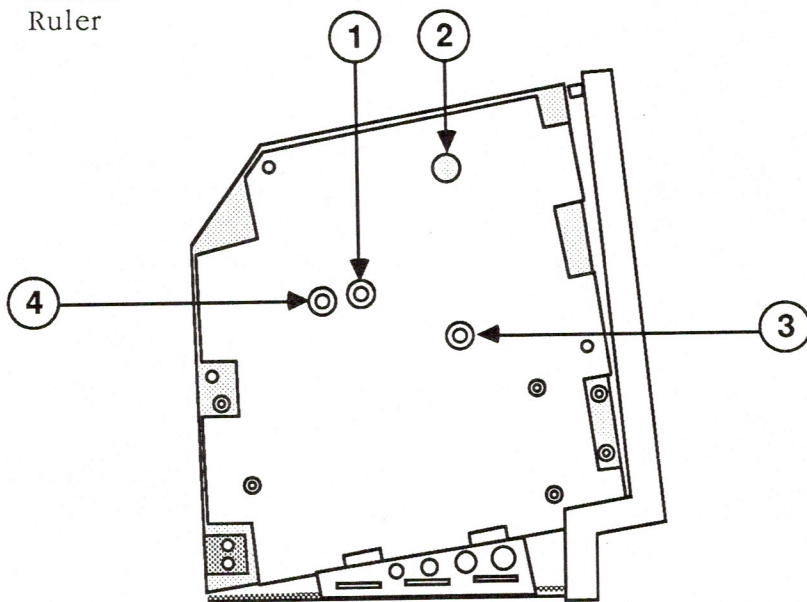


FIGURE 2

Adjustment Procedures

Brightness and Contrast

Size Adjustments

Focus Adjustment

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the computer with the side of the analog board facing you, and position the mirror so that the CRT screen is visible in the mirror.
4. Turn the contrast control fully clockwise. (The contrast control is on the front of the Macintosh SE, on the left hand side, under the Apple logo.)
5. Adjust the brightness control (Figure 2, #1) with the alignment tool: turn it fully counterclockwise so that white lines are visible on the screen. Then turn it back in the opposite direction until the white lines just disappear.
6. Turn the contrast control on the front panel slightly counterclockwise. This is the ideal adjustment.
7. Use the alignment tool to adjust the width (Figure 2, #2) until the picture is approximately 7 inches wide.
8. Use the alignment tool to adjust the height (Figure 2, #3) until the picture is approximately 4.7 inches high.
9. Turn the focus adjustment (Figure 2, #4) all the way clockwise until it doesn't turn anymore. Now turn it back in the opposite direction (counterclockwise) one-eighth of a turn. This setting gives the best overall sharpness at all points on the screen.

Macintosh SE

Section 4 – Diagnostics

□ CONTENTS

- 4.2 Introduction
- 4.3 Things To Remember
- 4.3 Making a Backup Diskette
- 4.4 Using Your Backup Diskette
- 4.5 800K Drive Copy Program
- 4.7 Running *MacTest SE*
- 4.7 Materials Required
- 4.7 Installing the Loopbacks
- 4.8 Using the *MacTest SE* Menus
- 4.10 Running the Tests
- 4.11 SCSI Loopback Jumper Procedure
- 4.11 To Determine if a Jumper Is Needed
- 4.12 To Install the Jumper

□ INTRODUCTION

The *MacTest SE* diagnostic diskette is used to test the Macintosh SE main logic board, internal and external floppy disk drives, and SCSI bus. It also provides a grid display for use in adjusting the CRT.

MacTest SE does not test the internal SCSI hard disk.

To test the hard disk, use the *Macintosh Hard Disk Drive Diagnostic* diskette (see Section 3, Diagnostics, in the *Hard Disk 20SC Technical Procedures*.)

The internal 96-pin Euro-DIN expansion bus connector on the Macintosh SE logic board cannot be tested by *MacTest SE*. (Test the bus connector by verifying the functionality of a card installed in the slot.)

MacTest SE is a pass/fail confidence test. As the test progresses, messages on the screen indicate which area is under test. As soon as a failure is detected, the test stops and the screen indicates which module must be replaced before the test can be run to completion.

Note: If you cannot start up the diskette, check the power cable and internal cable connections. If the cables are OK, turn to Section 5, Troubleshooting, and replace the module(s) specified for the problem you have observed. Attempt to start up the diskette after each module swap to see if the problem has been solved.

□ THINGS TO REMEMBER

Making a Backup Diskette

Make a backup diskette before you begin! When testing a defective Macintosh SE, it is possible to damage or erase a section of the *MacTest SE* diskette.

The *MacTest SE* diskette cannot be copied using a Macintosh SE because the *800K Disk Copy* program, contained on the *MacTest SE* diskette, was originally designed to work on the Macintosh Plus. Therefore, to make a copy of the *MacTest SE* diskette, you must use:

- A Macintosh Plus
- An 800K external drive
- The *800K Drive Copy* program, contained on the *MacTest SE* diskette
- A blank 800K diskette

To make a valid copy of your *MacTest SE* diskette, follow the instructions in the next section, "800K Drive Copy Program." **Note the following precautions:**

- You cannot make a copy by simply dragging the disk icon onto a new diskette. (The reserved tracks used for disk drive testing will not be properly reserved on the new disk.)
- You cannot use a different backup program to copy the contents of the diskette. (The resulting copy of the *800K Drive Copy* program would be unusable.)
- You must use a Macintosh Plus to make the copy because the *800K Drive Copy* program does not work correctly on the Macintosh SE.
- The *800K Drive Copy* program will not work if you attempt to copy to an external drive that is connected (daisy-chained) through a non-SCSI Hard Disk 20.
- Do not turn on the memory cache when you are using the *800K Drive Copy* program. There may not be enough memory left in RAM to copy the contents of the diskette.
- When you have made a correct copy of *MacTest SE*, put your master diskette away for safekeeping. Never run the tests from the master diskette—use it for making copies only!

Using Your Backup Diskette

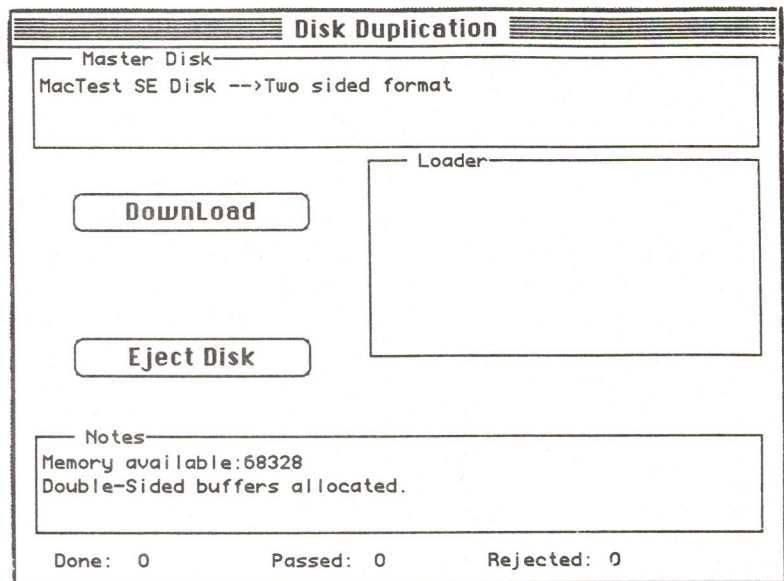
Note the following precautions when using your *MacTest SE* diskette copy:

- Do not write-protect your working copy of the *MacTest SE* diskette. (The program will not run correctly if you do.)
- Do not replace the system or finder provided on the *MacTest SE* diskette. The versions used on the diskette are Finder 5.4 and System 4.0. *MacTest SE* is not guaranteed to work with other versions.
- Do not change the name of the diagnostic program on the diskette. During logic board testing, the machine reboots and looks for and restarts the diagnostic named *MacTest SE*. If the name of the diagnostic has been changed, the startup routine will not be able to locate it, and the system will stay on the desktop.

Therefore, if the *MacTest SE* window does not reappear after a logic board test, check the name of the diagnostic's icon on the desktop. Correct it to *MacTest SE*, then select **Set Startup** from the desktop **Special** menu. When you are asked if you wish to change the name of the startup application to *MacTest SE*, click **OK**. Then double-click on the corrected *MacTest SE* icon to return to the test program.

□ 800K DRIVE COPY PROGRAM

1. Set up a Macintosh Plus with an external 800K drive.
2. Insert the *MacTest SE* master diskette into the internal drive of the Macintosh Plus, and power on the system.
3. An error message will warn you that this computer is not a Macintosh SE, and that this test (*MacTest SE*) works only with a Macintosh SE. Ignore the message and click on **Exit**. The desktop will appear.
4. Double-click on the **800K Drive Copy** icon. The following window will appear.



Wait until the **Wristwatch** icon disappears.

5. Click in the box labeled **Download**.

The message "Disk Download in progress...." will appear in the box labeled **Notes**. The drive will whirl for approximately one minute, then will eject the *MacTest SE* diskette. The message "Disk Successfully Downloaded" will appear in the box labeled **Notes**.

6. Insert a double-sided blank diskette into the external disk drive.
7. Click in the box labeled **Start**.

The message "Format/Copy in progress" will appear in the box labeled **Notes**. The drive will whirl, and the message will change to "Verify in progress." The message will change to "Disk Copy is successful" and the copy will be ejected from the external disk drive.

8. You now have two choices.

a) If you wish to make additional copies:

- 1) Insert another blank diskette into the external drive.

The program will make another copy without any commands being entered.

- 2) Repeat this until you have the number of copies you require.

b) If you wish to quit making copies.

- 1) Click in the box labeled **Stop**.
- 2) Pull down the **Options** menu and select **Quit**.
- 3) Insert the *MacTest SE* diskette, as instructed in the dialog box.

The desktop will return.

You now have a copy of the *MacTest SE* diskette. Place the original in a safe place.

□ RUNNING *MACTEST SE*

Materials Required

MacTest SE diagnostic diskette (copy)
Mini DIN-8 to mini DIN-8 Serial Port Cable
SCSI Loopback Test Card (modified with jumper—see
"SCSI Loopback Jumper Procedure")
Blank formatted 800K diskette for external drive test

Note: If there is an expansion card installed in the 96-pin Euro-DIN connector on the logic board, remove it before beginning.

Installing the Loopbacks

Before beginning *MacTest SE*, and **with the power off**, connect the serial loopback cable, the SCSI loopback card, the keyboard and mouse, and the external drive (optional).

The SCSI loopback card cable must be connected to the SCSI port on the back of the Macintosh SE. (No other connections between the card and the Macintosh SE are necessary.) To protect the SCSI circuitry, you must have the power off when you connect the SCSI card.

Note: When the SCSI loopback card is connected, the internal SCSI hard disk will not be able to respond, nor will it be recognized by the system.

The loopback cable with the mini DIN-8 connectors must be installed between the two serial ports on the rear of the machine.

Using the MacTest SE Menus

Insert the *MacTest SE* diskette into the internal drive, and power on the system. The *MacTest SE* test window will appear. The menus available from the *MacTest SE* window are described below.

Options Menu

The **Options** menu contains two submenu choices:

1. **Configuration:** This selection brings up a window that indicates the amount of memory and the version number of the ROMs in the Macintosh SE under test.
2. **Test Selections:** This window allows you to select the tests you wish to run:
 - a) **Logic:** This test verifies the correct functioning of the following components and connectors on the board:
 - VIA (Versatile Interface Adaptor)
 - Serial ports
 - Clock
 - SCSI bus
 - Memory (RAM)

You may select a short (1-minute) or long (5-minute) logic test.

- b) **800K Drives:** You may test any or all of the drives (except internal or external hard disks):
 - First (lower)
 - Second (upper)
 - External

Note: The diagnostic will not test an external disk drive that is connected through a non-SCSI Hard Disk 20.

- c) **Video:** This test provides a CRT grid pattern that allows you to check the adjustment of the video picture.

Note: This is not a pass/fail test, but a test pattern that is displayed on the screen before the other selected tests run. When you have made any necessary video adjustments, press the mouse button or hit any key to go on with the remainder of the selected tests or, if there are no other selected tests, to return to the *MacTest SE* window.

- d) **Loop on All Selected Tests:** This selection provides a continuous running (in sequence) of all selected tests except the CRT grid. To stop the looping, click the **Stop** box between tests (that is, when the screen displays an arrow rather than a wristwatch).

To select a test, click in the box next to the name of the item to be tested. The box will display an X. To deselect the test, click again in the box and you will notice that the X is gone. When you have selected all the tests you wish, click in the **OK** box. You will be returned to the *MacTest SE* window.

Note: You may cause a system error if you deselect all the tests and then click on **Start**.

File Menu

The **File** menu allows you two choices:

1. **Save Test Selections:** Allows you to customize your *MacTest SE* diskette by saving your selection of tests for the next time you use *MacTest SE*. The default configuration is the short logic test and first (lower) drive test.

IMPORTANT: *The diskette must be unlocked before you try to save your selections.*

2. **Quit:** Returns you to the desktop.

Apple Menu

The Apple (🍏) menu allows you to access the **KeyCaps** desk accessory to check the operation of the Apple DeskTop Bus keyboard. When selected, **KeyCaps** displays a window with a keyboard. Press each key on the keyboard and verify that the display block for that key is highlighted. If the key is not highlighted, the keyswitch is bad and the keyswitch should be replaced. If numerous keys are not highlighted, exchange the keyboard.

Running the Tests

After you have used the **Test Selections** window to specify the tests you wish to run, you are ready to start *MacTest SE*. Click on the **Start** box in the *MacTest SE* window. The testing will begin. Please note the following:

- If the SCSI loopback card is missing or improperly installed, you will be instructed at once to turn off the power, disconnect all external SCSI drives, and connect the SCSI loopback card.
- If the serial loopback cable is missing or improperly installed, the testing will begin, but the serial ports test will fail. You will be instructed to make sure the serial loopback cable is connected, then to click on **Continue** to retry the failed test. (You can connect the serial loopback cable without powering off the system.)
- The logic board test causes several seconds of startling graphics to be displayed on the screen before the program reboots to the *MacTest SE* window. Ignore them.
- You may halt the testing by clicking on **Stop** or **Pause** any time between tests (that is, when the screen displays an arrow rather than a wristwatch).
 - Choose **Stop** to halt the testing and to return to the **Waiting for Start** state. Choose **Start** when you wish to begin the testing sequence again.
 - Choose **Pause** if you wish to discontinue testing temporarily. Choose **Continue** to resume the tests from the point of interruption.

Replace any module that the test indicates is faulty. Then run *MacTest SE* again to make sure the problem has been corrected. If the system is still not operating properly, turn to Section 5, Troubleshooting, for more information.

If all tests pass, the Macintosh SE will return to the *MacTest SE* window. The message **All tests passed** will be displayed briefly. A **Happy Macintosh** icon will be displayed in the upper left corner of the screen's graphic area until you reboot or start the test again.

❑ SCSI LOOPBACK JUMPER PROCEDURE

To Determine if a Jumper Is Needed

To be used with *MacTest SE*, the SCSI loopback card must be jumpered between Pin 25 of J1 and Pin 14 of RP1. On new SCSI loopback cards, the jumper has been etched into the printed circuit. Only cards with the old PCB artwork need the jumper procedure.

Note: This modification does not interfere with the card's use on other Macintosh or Apple II family systems, except that to work on Apple II systems it must be connected to a notched mouse cable. (For further information on the notched cable, refer to *Hard Disk 20SC Technical Procedures*, Appendix A, "SCSI Interface Card.")

To Identify a New Card

To determine if you have a new card, which will not need to be jumpered, look at the back of the card. If the jumper is included in the artwork, there will be an **A** instead of double zeros (00) at the end of the part number, which is located under the words "APPLE COMPUTER" (Figure 1, #1). **These new cards do not have to be jumpered.**

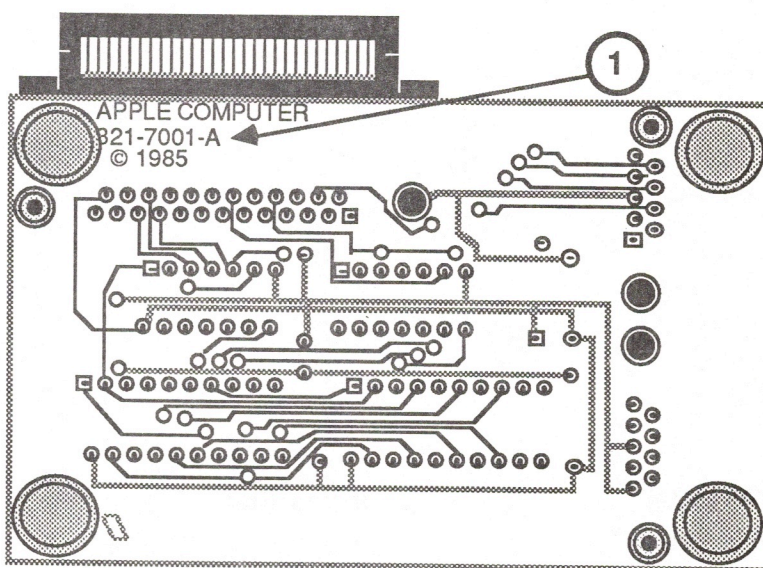


FIGURE 1

*External
Jumpers on
Old Cards*

Some cards with the **00** part number and the old artwork were modified with an external jumper during the manufacturing process. Therefore, if your card has a **00** part number, check to see if it has an external jumper from Pin 25 of J1 to Pin 14 of RP1 (Figure 2, #1). If it has no external jumper, you must install one yourself.

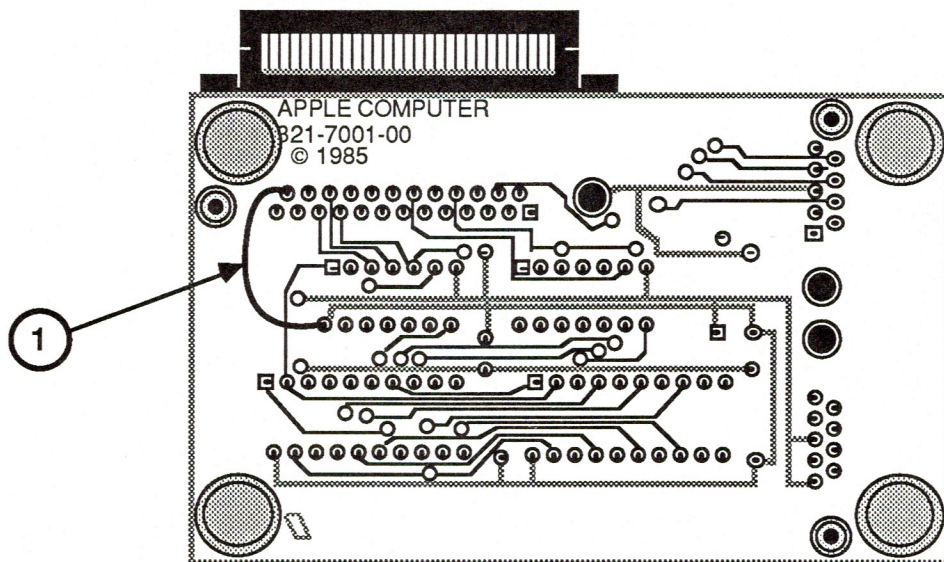


FIGURE 2

Summary

To summarize:

**If # on back
ends with:**

Do this:

A

Nothing
(Jumper is present in artwork.)

00

Check to see if external jumper
is present. If not, install jumper.

**To Install
the Jumper**

If you find that the card must be jumpered, solder a wire connection between Pin 25 of J1 and Pin 14 of RP1, as shown in Figure 2. (The pins are not numbered on the board. In the orientation shown in Figure 2, Pin 25 is the pin closest to the upper left corner of the card, and Pin 14 is in the middle line of pins, closest to the left edge of the card.)

Macintosh SE

Section 5 – Troubleshooting

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5.2	Introduction
5.2	General Information
5.2	How to Use the Symptom Chart
5.2	Things to Remember
5.3	Symptom Chart
5.3	Video Problems
5.4	Drive Problems
5.6	Peripheral Problems
5.7	Miscellaneous Problems
5.8	Isolating a Faulty SIMM

□ INTRODUCTION

General Information

There are two diagnostic tests that may be used to test portions of the Macintosh SE system:

- *MacTest™ SE*
- *Macintosh Hard Disk Drive Diagnostic* (version 3.0 or higher)

Use this troubleshooting section if you are unable to boot the diagnostic diskette or if the diagnostics are unable to detect a module failure. After you repair the system, run the diagnostic tests again to verify system operation.

How to Use the Symptom Chart

Find the symptom that most nearly describes the problem, then perform the corrective actions in the order listed. If a corrective action does not fix the problem, go to the next action. **If you replace a module and find that the problem remains, reinstall the original module before you go on to the next action.**

Things to Remember

1. Read all the safety precautions before removing or installing any modules. (See Section 1, Basics.)
2. Follow all ESD precautions when troubleshooting. (See *You Oughta Know* for more information.)
3. Perform the CRT discharge procedure before removing or installing any modules. (See Section 2, Take-Apart.)
4. Use known-good software. Bad software can produce symptoms that appear to be hardware problems.

□ SYMPTOM CHART

Video Problems

Solutions

- *Screen dark, audio and drive operate*
 1. Turn brightness control clockwise.
 2. Check video cable connections.
 3. Replace analog board.
 4. Replace video board.
 5. Replace main logic board.

- *Screen bright and audio present, but no video information visible*
 1. Replace main logic board.
 2. Replace analog board.
 3. Replace video board.

- *Screen is completely dark and fan is not running*
 1. Replace power supply.
 2. Replace analog board.

- *Screen is completely dark but fan is running*
 1. Replace logic board.
 2. Replace analog board.
 3. Replace video board.

Drive Problems

Solutions

- *Audio and video present but one internal 800K drive does not operate*
 1. Replace bad diskette.
 2. Replace internal disk drive.
 3. Replace internal disk drive cable.
 4. Replace main logic board.
- *Audio and video present but neither internal 800K drive operates*
 1. Replace bad diskette.
 2. Replace main logic board.
- *External 800K drive does not operate*
 1. Replace bad diskette.
 2. Be sure the external drive is placed on the right side of the Macintosh SE.
 3. Replace external drive.
 4. Replace main logic board.
- *Disk ejects, display shows icon with blinking "X"*
 1. Replace diskette with known-good system diskette.
 2. Replace disk drive.
 3. Replace main logic board.
- *Unable to insert diskette all the way*
 1. Insert opened paper clip into hole beside the drive.
 2. Power off system and hold mouse button down while powering on (to complete eject cycle).
 3. Replace disk drive.
- *Will not eject diskette*
 1. Insert opened paper clip into hole beside the drive.
 2. Power off system and hold mouse button down while powering on.
 3. Replace disk drive.

- *800K disk drive runs continuously*

1. Replace bad diskette.
2. Replace disk drive.
3. Replace main logic board.
4. Replace disk drive cable.

- *Internal or external hard disk will not operate*

1. Replace hard disk.
2. Replace main logic board.
3. Replace hard disk drive cable.

Peripheral Problems

Solutions

- *Cursor does not move*
 1. Check mouse connection.
 2. If mouse was connected to keyboard, connect it to a rear ADB port instead. If mouse works, keyboard should be replaced.
 3. If mouse does not work in any ADB port, replace mouse.
 4. Replace main logic board.
- *Cursor moves but clicking the mouse button has no effect*
 1. Replace mouse.
 2. Replace main logic board.
- *No response to any key on the keyboard*
 1. Check keyboard connection to ADB port.
 2. Replace keyboard cable.
 3. Replace keyboard.
 4. Replace main logic board.
- *Known-good ImageWriter or ImageWriter II will not print*
 1. Make sure that the Chooser and the Control Panel are set correctly.
 2. Replace software with known-good.
 3. Replace printer interface cable.
 4. Replace logic board.
- *Known-good LaserWriter will not print*
 1. Make sure that the Chooser and the Control Panel are set correctly.
 2. Replace software with known-good
 3. Refer to the *Networks* tab in the *Apple Technical Procedures*.

Miscellaneous Problems

Solutions

- *Clicking or chirping, or thumping sound*
 1. Verify analog board cable is connected at J12 on the logic board.
 2. Replace power supply.
 3. Replace analog board.
 4. Replace logic board.
- *Smoke/odor*
 1. Replace power supply.
 2. Replace analog board.
- *No video, no audio, and no drive operation*
 1. Connect power cord.
 2. Turn power on.
 3. Replace power cord.
 4. Replace power supply.
 5. Replace analog board.
 6. Replace main logic board.
- *"Sad Macintosh" icon*
 1. Replace bad diskette.
 2. Replace SIMM(s) if code matches any of those given in "Isolating a Faulty SIMM" chart.
 3. Replace logic board.

Isolating a Faulty SIMM

When the Macintosh SE is powered on, the ROM runs a series of logic board tests. Failure of any of these tests results in the display of a "Sad Macintosh" icon on the screen. The icon is shown with two rows of eight-digit numbers that indicate the particular fault identified by the test. The numbers that represent SIMMs faults are shown below (the designation XX indicates the presence of any number other than 0 in **either or both** of the two positions):

Code	Replace
0000000E 000000XX	SIMM # 1
0000000E 0000XX00	SIMM # 2
00000002 000000XX	SIMM # 1
00000002 0000XX00	SIMM # 2
00000004 000000XX	SIMM # 3
00000004 0000XX00	SIMM # 4

Note: Depending on the type of fault, the "Sad Macintosh" display may not be entirely readable. In such a case, press the reset/interrupt switch. The code may flash very quickly before the machine attempts to reboot. An unreadable code often indicates a fault with the SIMM at position 3 or 4, so if you cannot find a way to read the code, try replacing these two SIMMs, one at a time.

Macintosh SE

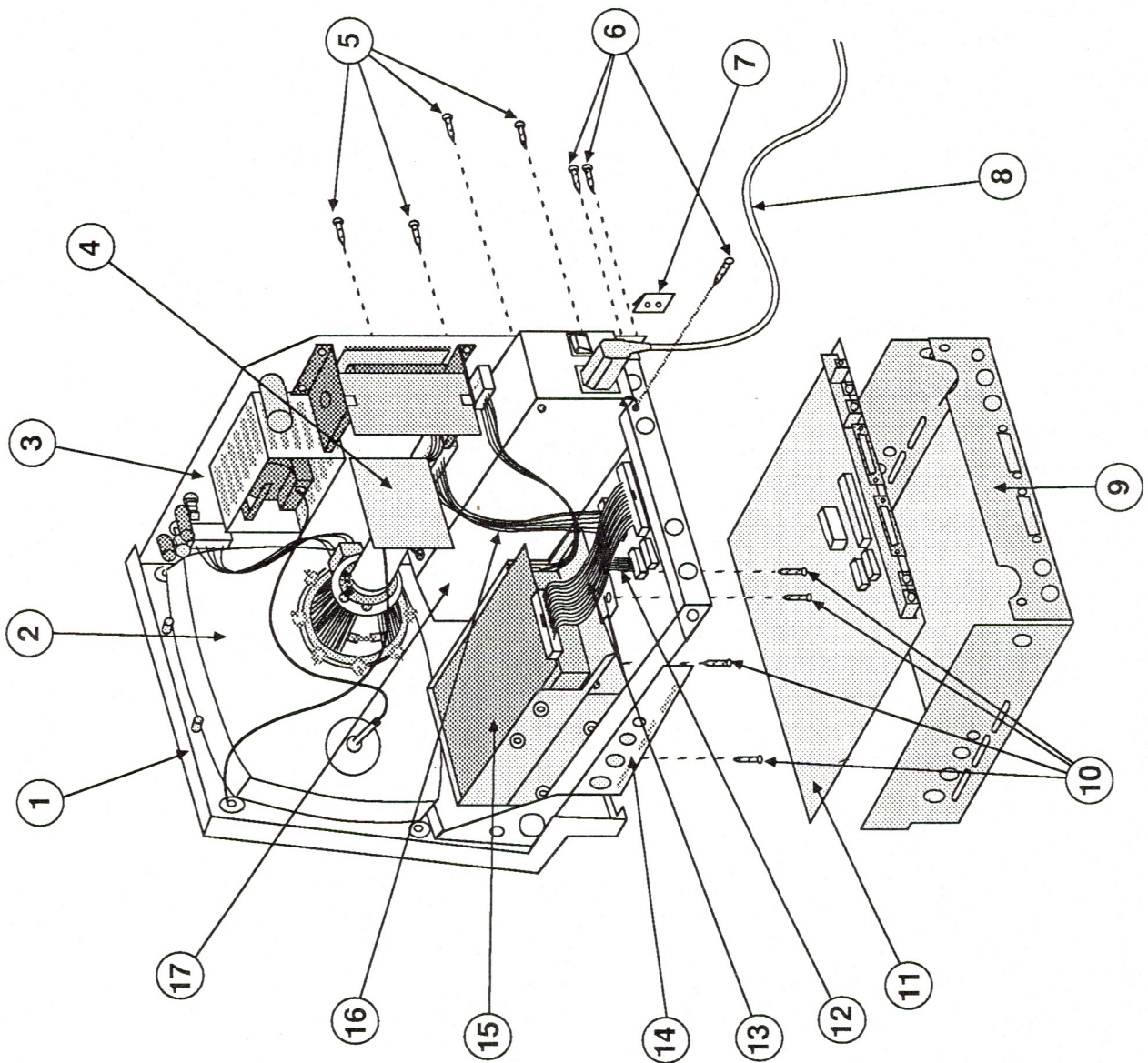
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IPL.5	External Rear Housing (Figure 2)
IPL.7	Front Bezel (Figure 3)
IPL.9	Logic Board (Figure 4)
IPL.11	Analog Board (Figure 5)
IPL.13	Internal 800K Drive, Shipping Fixture (Figure 6)
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IPL.17	Keyboard (Figure 9)
IPL.19	Extended Keyboard (Figure 10)
IPL.21	Mouse (Figure 11)
IPL.23	Service Packaging, 3.5 HDA (Figure 12)

The figures and lists above include all piece parts that can be purchased separately from Apple for the Macintosh SE, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

FIGURE 1



□ **MACINTOSH SE – INTERNAL VIEW (Figure 1)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	810-0399	Front Bezel with Speaker, Slot Cover
2	076-0103	CRT and Yoke Assembly
3	661-0371	Macintosh SE Analog Board
4	661-0372	Macintosh SE Video Board
5	462-3100	Screw, 3 x .5 x 6 mm
6	470-2101	Screw, 2.9 x 10 mm
7	805-0576	Lower Ground Clip
8	590-0380	AC Power Cable
9	805-5060	RFI Shroud
10	462-4100	Screw, 3.5 x .6 x 8 mm, Pn Crs Rec
11	661-0369	Macintosh SE Logic Board
12	590-0437	3.5-Inch Internal Drive 1 Cable (yellow stripe)
13	590-0211	HDA I/O Cable
14	630-5303	Chassis
15	661-0373	HDA, 3.5, 20M, SCSI
16	590-0392	Logic Board Power Cable
17	661-0370	Macintosh SE Power Supply

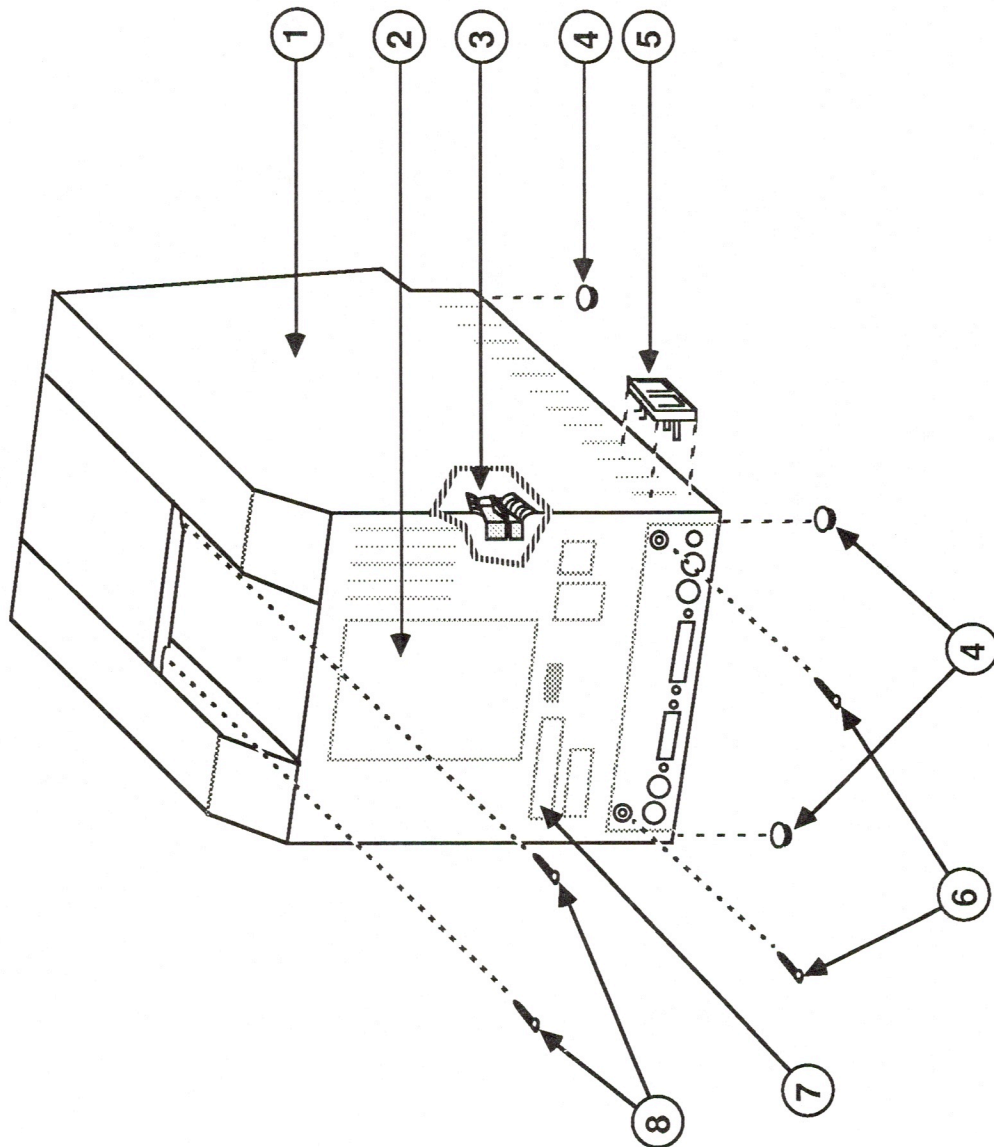


FIGURE 2

□ **MACINTOSH SE – EXTERNAL REAR HOUSING (Figure 2)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5271	Rear Housing Assembly with Door and Feet
2	825-1470	Agency Approval Label with HDA
	825-1471	Agency Approval Label with Dual Drive
3	805-0575	Upper Ground Clip
4	865-0051	Platinum Foot
5	815-1008	Push-Button Programmer's Switch
6	426-1001	Tapping Screw
7	815-0986	Rear Housing Door
8	435-5002	Screw, Tap, 8-32 x .625, Fill, Torx, Zinc Oxide

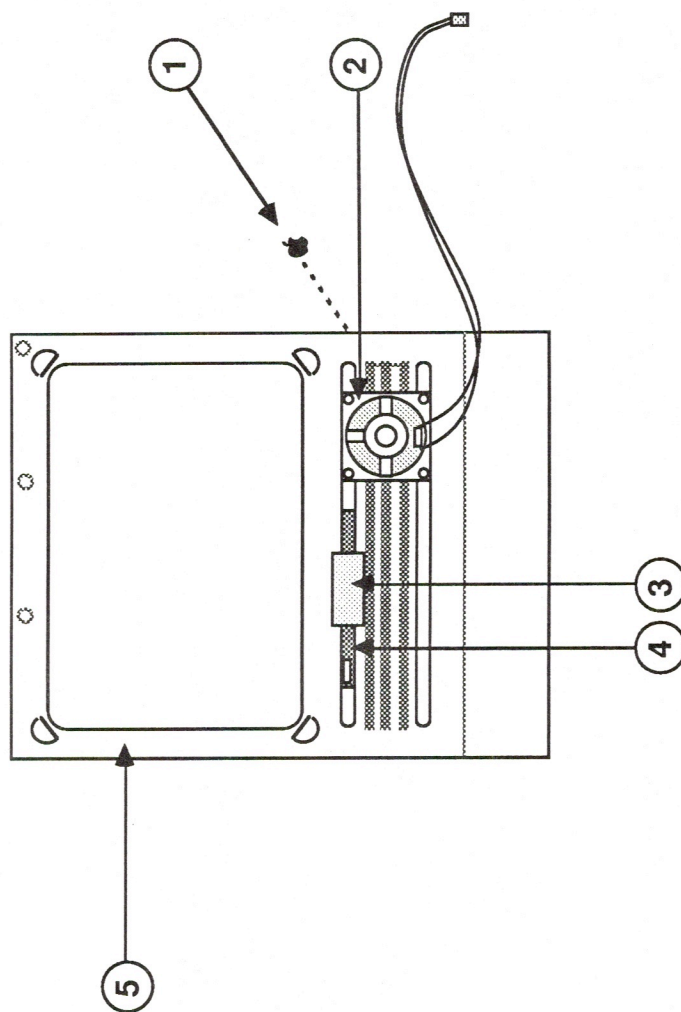


FIGURE 3

□ MACINTOSH SE – FRONT BEZEL (Figure 3)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	825-1256	Macintosh Plus/SE Logo Plate Label
2	600-0393	Speaker
3	805-0908	Slot Cover Retainer
4	630-5330	Bezel Slot Cover
5	810-0383	Front Bezel

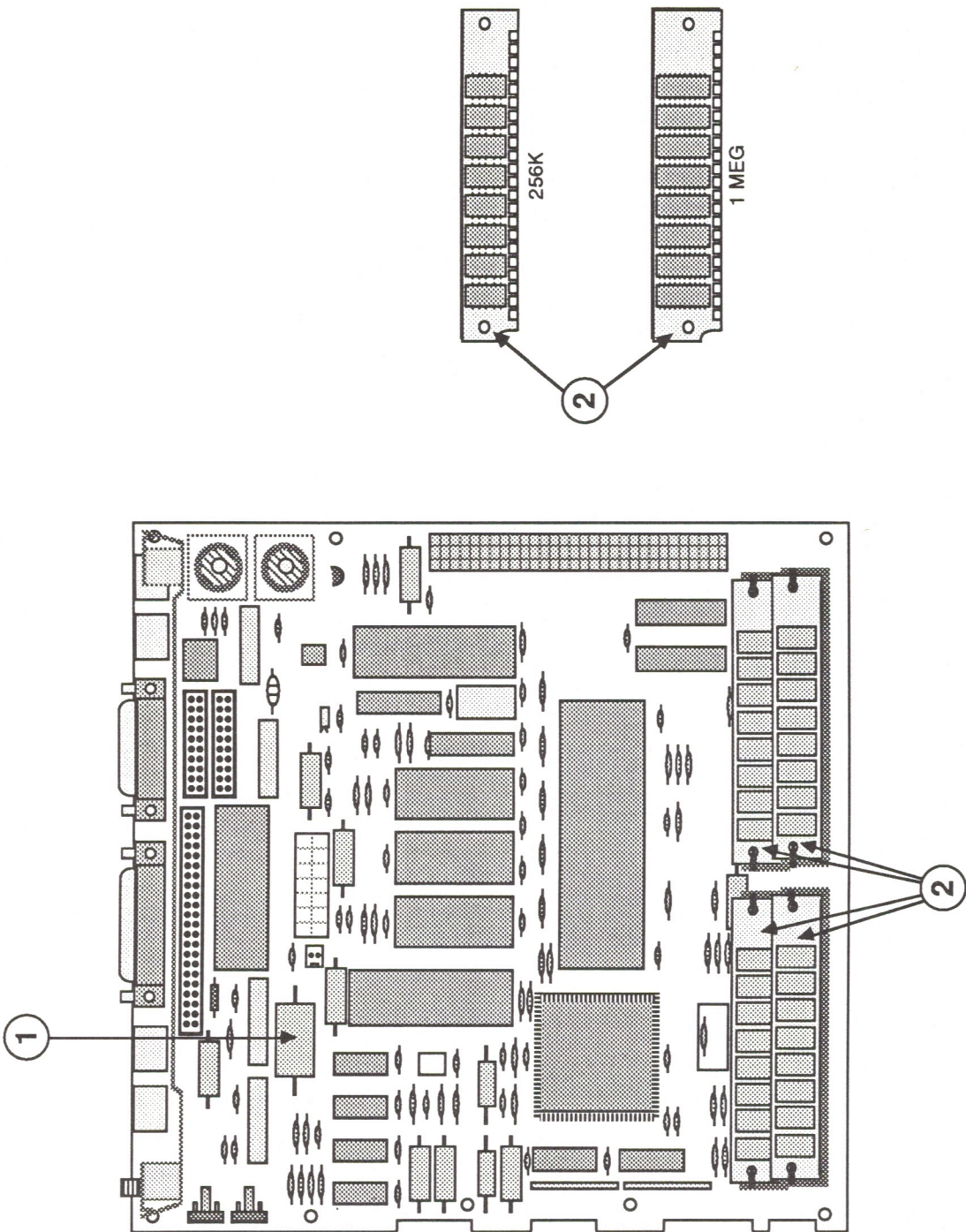


FIGURE 4

□ **MACINTOSH SE – LOGIC BOARD (Figure 4)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	742-0009	Battery
2	661-0402	SIMMs RAM, 120ns, 256K
	661-0403	SIMMs RAM, 120ns, 1M

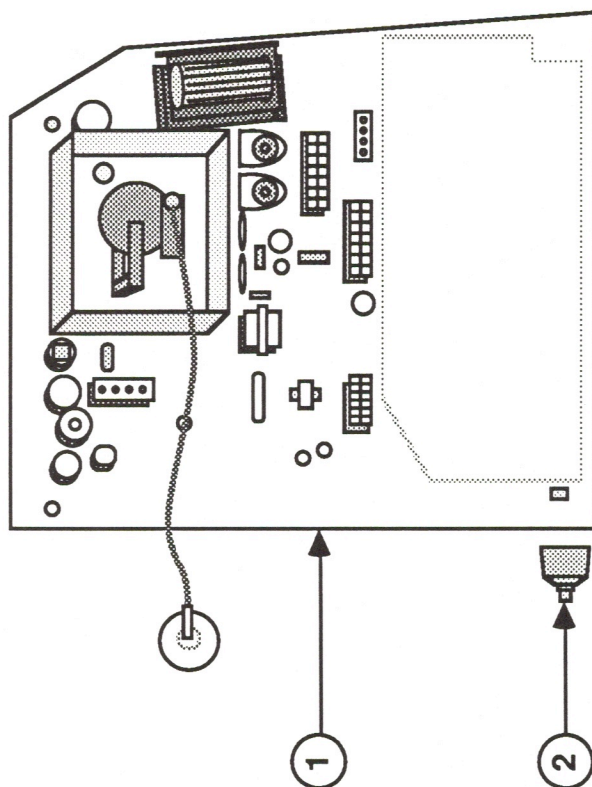


FIGURE 5

□ **MACINTOSH SE – ANALOG BOARD (Figure 5)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0371	Macintosh SE Analog Board
2	865-0047	Brightness Knob

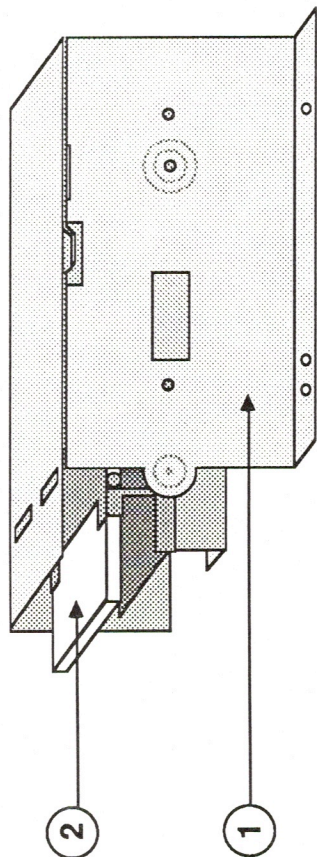


FIGURE 6

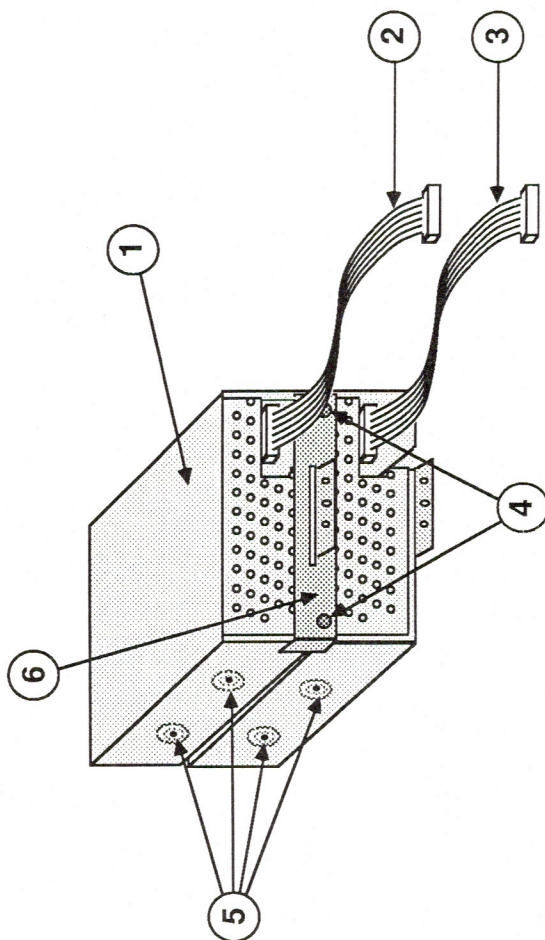


FIGURE 7

□ **MACINTOSH SE – INTERNAL 800K DRIVE, SHIPPING FIXTURE**
(Figure 6)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0217	Shield for Internal 800K Drive (shipping fixture)
2	003-0003	Packing Diskette, 2-Sided (for transporting)

□ **MACINTOSH SE – DUAL INTERNAL 800K DRIVES (Figure 7)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0345	800K Mechanism, Apple 3.5 Drive
2	590-0188	3.5-inch Internal Drive Cable (yellow stripe)—SE upper drive
3	590-0437	3.5-inch Internal Drive 1 Cable (yellow stripe)
4	462-4100	Screw, 3.5 x .6 x 8 mm, Pn Crs Rec
5	462-3401	Screw, 3 x 6 mm, with two washers
6	805-0915	Back Plate, Drive 2

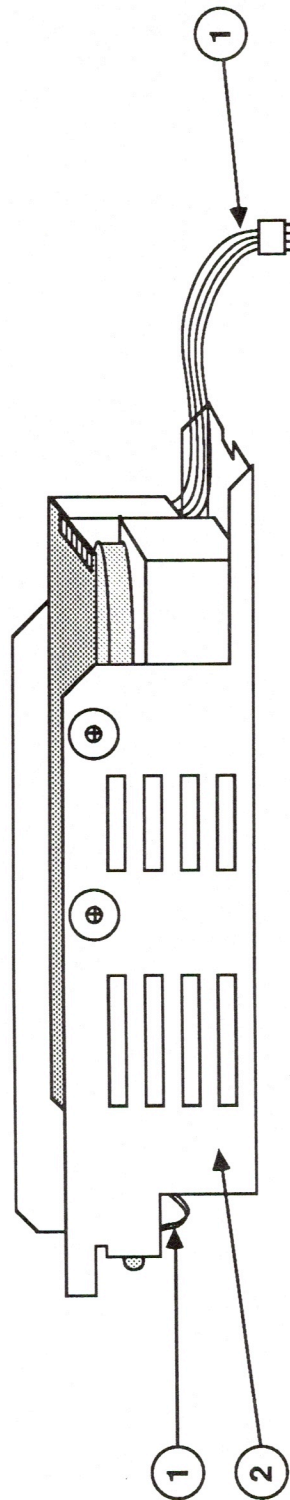


FIGURE 8

□ **MACINTOSH SE – INTERNAL HDA (Figure 8)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0373	HDA, 3.5, 20M, SCSI
1	590-0364	HDA Power Cable
2	805-5066	HDA Metal Housing
3	590-0237	LED Cable

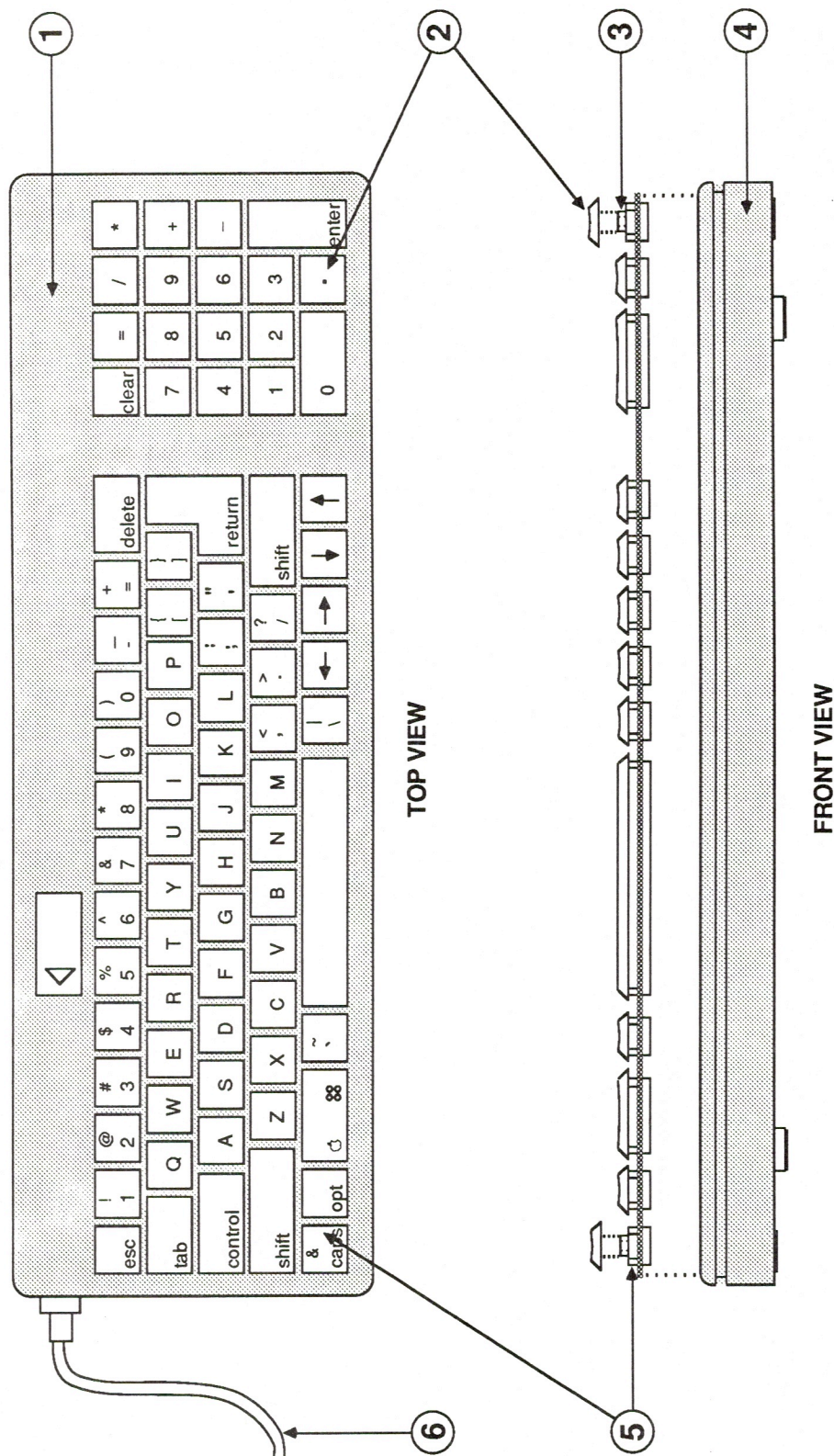


FIGURE 9

□ MACINTOSH SE – KEYBOARD (Figure 9)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0383	Apple Keyboard
1	815-1016	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1017	Case Bottom
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard

□ MACINTOSH SE – EXTENDED KEYBOARD (Figure 10)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0384	Apple Extended Keyboard
1	815-1018	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1019	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard

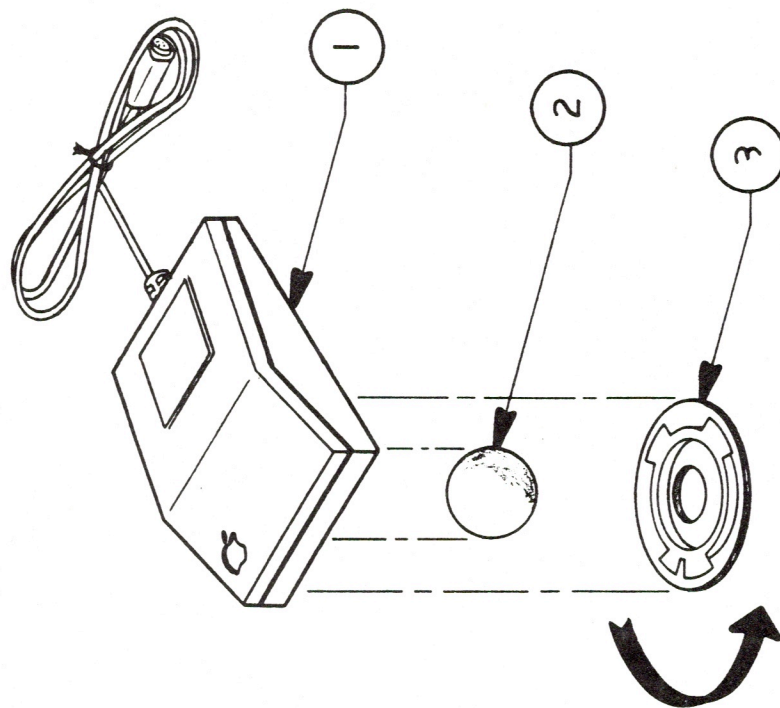


FIGURE 11

□ MACINTOSH SE – MOUSE (Figure 11)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0338	Apple Desktop Bus Mouse
1	699-8007	Rubber Coated Mouse Ball
2	076-0231	ADB Mouse Ball Retainer

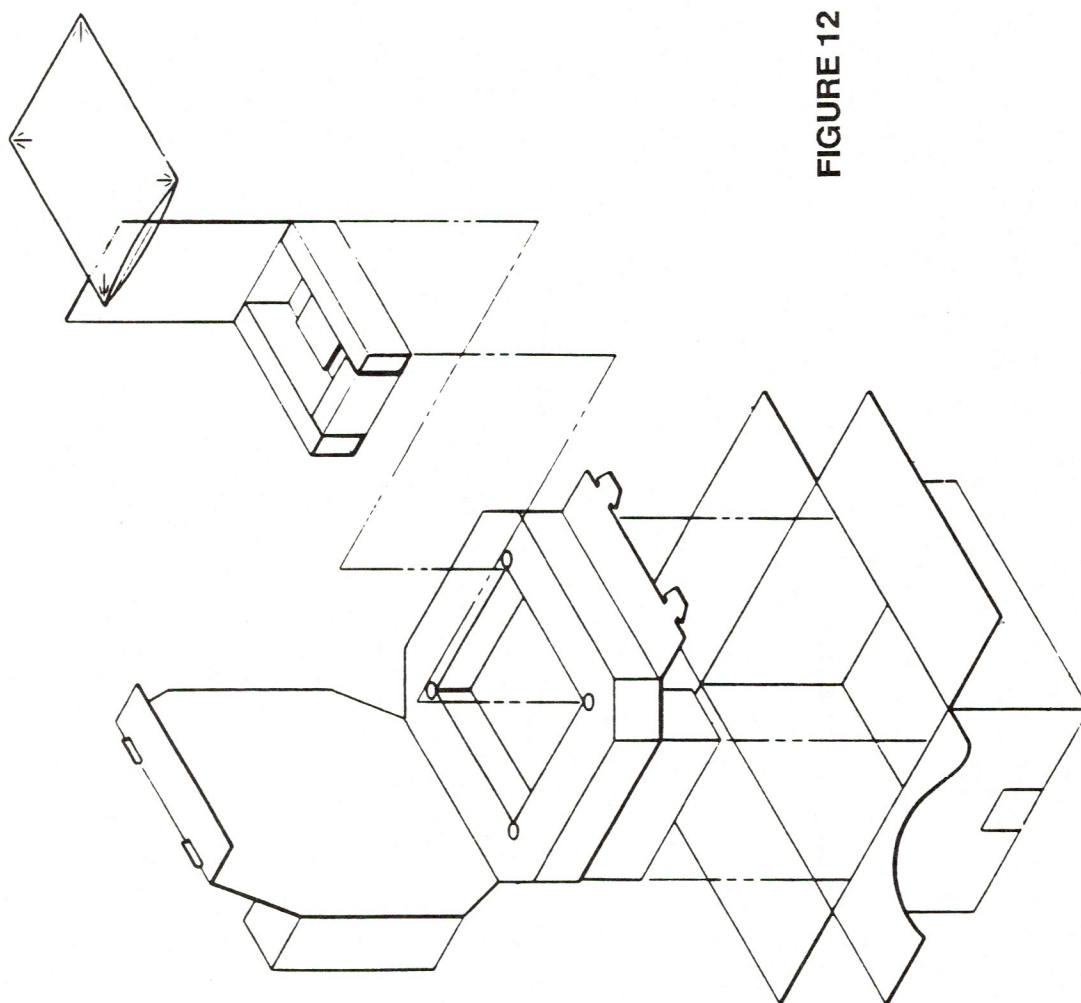


FIGURE 12

□ **MACINTOSH SE – SERVICE PACKAGING, 3.5 HDA (Figure 12)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	602-0164	Service Packaging, 3.5 HDA

**End of Macintosh
SE Section Start of
Macintosh II Section**

Macintosh II

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Macintosh II

Section 1 – Basics

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□ PRODUCT DESCRIPTION

The Macintosh II is a high-performance, open-architecture Macintosh. As the high-end computer of the Macintosh line, it was designed to run existing software while providing the power, flexibility and expandability necessary for future applications.

New Features

The Macintosh II has the following new features:

- Increased speed
- More RAM (up to 8 megabytes installed on the logic board)
- Expansion slots
- Larger video screen and color monitor option
- Compatibility with previous Macintosh systems
- Compatibility with alternative operating systems

Configurations

The Macintosh II will be available in two configurations: the entry system and the hard disk system.

Entry System

The entry system includes the following elements:

- 68020 microprocessor
- 68881 floating point co-processor
- Hochsprung Memory Management Unit (HMMU)
- 1 Megabyte of RAM
- 1 800K internal 3.5-inch disk drive

The following enhancement kits can be added to the entry system:

- One 800K internal 3.5-inch disk drive
- 20, 40, or 80 Megabyte SCSI hard disk
- 68851 Programmable Memory Management Unit (PMMU)
- RAM up to 8 Megabytes

Hard Disk System

The hard disk system includes the following elements:

- 68020 microprocessor
- 68881 floating point co-processor
- Hochsprung Memory Management Unit (HMMU)
- 1 Megabyte of RAM
- 1 800K 3.5-inch disk drive
- 40 Megabyte internal hard disk SCSI

The following enhancement kits can be added to the hard disk system:

- 1 800K internal 3.5-inch disk drive
- 68851 Programmable Memory Management Unit (PMMU)
- RAM up to 8 Megabytes

□ CONNECTOR IDENTIFICATION

Back Panel

The back panel of the Macintosh II has six built-in ports, two connectors, and a reset switch, as listed below. The number beside the item below corresponds to the numbered arrow in Figure 1.

1. Apple DeskTop Bus 1 and 2
2. Serial Port 1 (Printer)
3. Serial Port 2 (Modem)
4. Sound Port
5. SCSI Port
6. AC Power Connector
7. Monitor Connector
8. Hardware on switch (reset)

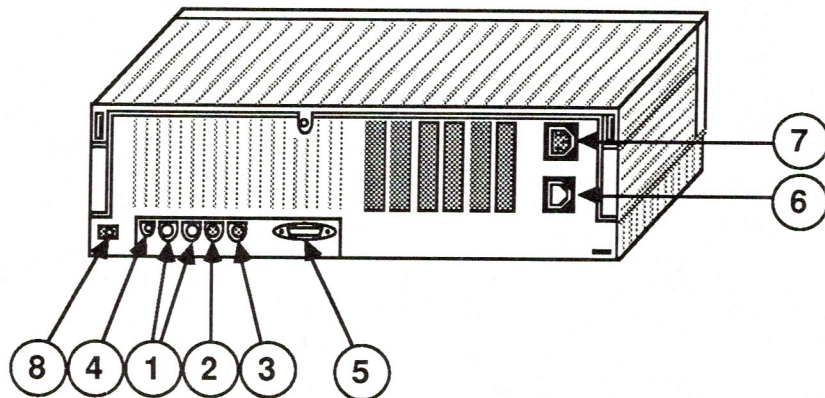


FIGURE 1

Internal Connectors

There are six connectors on the Macintosh II logic board. In the list below, the number beside the connector name corresponds to the numbered arrow in Figure 2.

1. Internal SCSI connector
2. Power connector for internal SCSI
3. Internal disk drive 2 (left)
4. Internal disk drive 1 (right)
5. Power connector for the logic board
6. Speaker connector

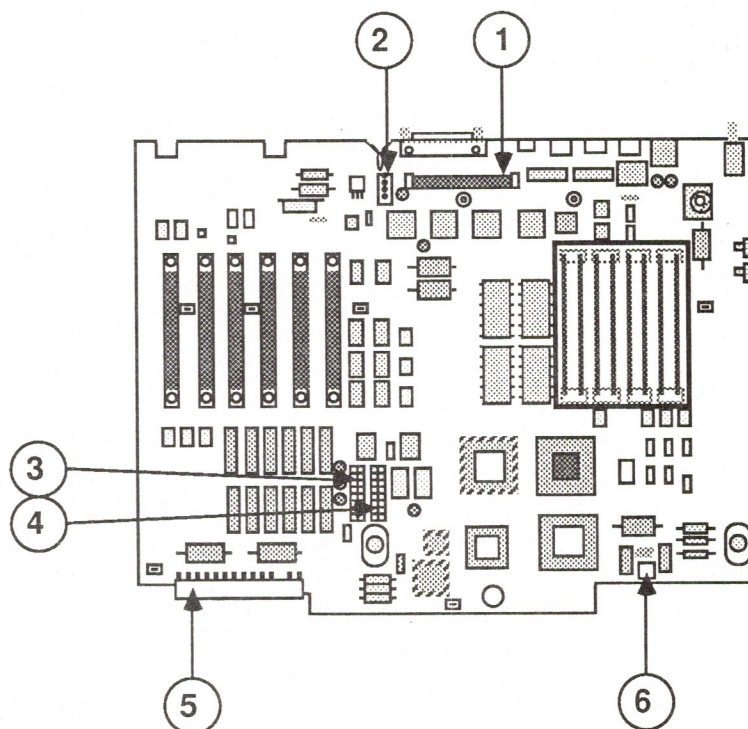


FIGURE 2

□ THEORY OF OPERATION

Introduction

The Macintosh II is made up of three basic modules: the logic board, the power supply, and the video interface card. Internally it can have one or two 800K disk drives and/or one hard disk SCSI.

The information here will provide you with an understanding of how the Macintosh II works. This, in turn, will assist you in performing logical troubleshooting on the Macintosh II system.

System Startup

The two replaceable batteries on the logic board monitor the reset switch. When the reset switch on the Macintosh II is pressed, the system begins a carefully synchronized sequence of events.

First the processor is held in a wait state while a series of circuits gets the system ready for operation. During this time, the Versatile Interface Adapters and the Integrated Woz Machine (described later in this section) are initialized, and the mapping of RAM and ROM is altered temporarily in order to test the system.

The system software then performs a RAM test to determine how much RAM is present in the machine. This information is then stored in a global variable, and several other system tests are performed. When the system is fully tested and initialized, system RAM is mapped for normal operation.

At this point the disk startup process begins. The system looks for a readable disk in the available disk drives in the following order:

1. Disk drive one (right side)
2. Disk drive two (left side)
3. Setup device set in the Control Panel
4. Internal SCSI hard disk (or SCSI hard disk with device ID of 0)
5. SCSI devices in declining order of device priority

Once a readable disk is found, it is read and the disk startup process is completed.

Logic Board

The logic board is the heart of the system, where all processing of information takes place. What follows is a list of the major components of the Macintosh II logic board and the functions they perform.

Microprocessor

The Macintosh II contains a 68020 microprocessor that supports both a 24- and 32-bit processing mode. The system runs at 15.6672 MHz for high performance. When running in the 24-bit processing mode, the Macintosh II is compatible with the majority of existing applications for the Macintosh.

The 68881 co-processor is a IEEE P754 standard floating point IC that can provide a high degree of precision and speed for the Macintosh II programs.

RAM

The RAM is provided in packages known as Single In-Line Memory Modules (SIMMs). Each SIMM consists of a small printed circuit board with eight surface-mounted dynamic RAM (DRAM) chips. On one edge of each SIMM is a contact that fits into the SIMM sockets located on the logic board.

The amount of RAM on the logic board can be changed by installing the same size SIMMs in either Bank A or B, with the larger RAM size in Bank A (the first four rows closest to the edge of the board).

Various RAM configurations are possible, depending on how many SIMMs are used and on the size of the DRAM chips.

Every time the Macintosh II is powered on, the system software performs a memory test to determine how much RAM is present in the machine.

ROM

The ROMs are the system's permanent Read Only Memory. The Macintosh II presently contains four ROM chips providing 256K of ROM. The Macintosh II ROMs contain the routines for the Toolbox, the Operating System, and other necessary system routines. The Macintosh II ROM sockets can accept ROM chips that would provide 512K of ROM.

An optional ROM configuration is the installation of a 64-pin SIMM into the ROM sockets on the Macintosh II logic board. This will allow upgrades to the ROM without replacing the logic board.

Versatile Interface Adapters

The Macintosh II contains two SY6522A Versatile Interface Adapters (VIAs). These chips, known as VIA1 and VIA2, provide maximum compatibility with existing Macintosh software.

VIA1

VIA1 provides the Macintosh II system with most of the signals from the 68000-based Macintosh configuration. It also provides access to new features, including an Apple DeskTop Bus interrupt and a synchronous modem signal.

VIA2

VIA2 controls the HMMU; decodes the NuBus Slot interrupts, a SCSI interrupt, and the Digital Sound Chip interrupt; powers the unit off; blocks NuBus accesses to RAM; and determines errors that occur in NuBus transactions.

The access time between the two VIA chips and the 68020 is 500ns. The VIA's internal frequency is 783.36 KHz.

HMMU

The Hochsprung Memory Management Unit (HMMU) allows Macintosh software to use the 24-bit address line mode of 68000-based Macintoshes while new software can use the new 32-bit address mode.

PMMU

The Programmable Memory Management Unit (PMMU or 68851) will allow the use of the UNIX operating system, as well as support both the 24-and 32-bit address modes.

Integrated Woz Machine

The Macintosh II is capable of supporting two internal 800K 3.5-inch drives. The disk interface uses the Apple custom Integrated Woz Machine (IWM) chip to control the drives. Together with the VIA, the IWM generates all the signals needed to read, write, format, and eject diskettes.

The IWM is clocked at 15.6672 MHz, which is twice the frequency used in previous Macintosh systems. An internal "divide by two" circuit is used to access 400K or 800K drives.

Small Computer Standard Interface

The Small Computer Standard Interface (SCSI) chip controls a high-speed parallel port for communicating with up to seven SCSI peripherals.

The Macintosh II SCSI port differs from the industry SCSI standard in two ways.

1. A DB-25 connector is used instead of the standard 50-pin ribbon connector. An adapter is available to convert the connector to the standard.
2. Power for termination resistors is not provided. If the attached SCSI device does not have the required terminator resistor, an Apple-manufactured terminator block must be installed on the last device.

Serial Communications Controller

The two serial ports are controlled by the Serial Communications Controller (SCC). Macintosh II serial ports conform to the EIA standard RS422.

The Macintosh II uses two Mini-DIN 8 connectors for the two ports. The ports provide an output handshake but do not provide the +5 and +12 volts found on the Macintosh 128K, 512K, and 512K enhanced serial ports.

Apple Sound Chip

The Apple Sound Chip generates a stereo/audio signal. This signal is filtered and buffered by two additional chips and then sent to the external stereo mini-phone jack and the internal speaker.

The sound generation system in the Macintosh II supports the previous Macintosh modes, while offering a complete set of new ROM tools in the Software Sound Manager for performing sound generation.

Real-Time Clock

The Macintosh II real-time clock is a custom chip. It contains 256 bytes of RAM that are powered by a battery when external power is turned off. These RAM bytes are called parameter RAM. They store the configuration of ports, the clock setting, and other data that needs to be preserved even when the system power is not available.

Apple DeskTop Bus

The Apple DeskTop Bus (ADB) is a serial communication bus used to connect keyboards, mouse devices, graphic tablets, and other input devices to the system. The mini 4-pin ADB connector connects the devices to the Macintosh II.

The microprocessor normally samples the state of each device by using the control lines in VIA2 to read or write to the Apple DeskTop modem chip.

ADB Devices

All devices that are made for the Apple DeskTop Bus have some kind of microprocessor that makes them intelligent devices. All ADB devices, except the mouse, have ports for connecting other ADB devices. The mouse must be the last device attached to the Apple DeskTop Bus because it has no port.

There are two Apple ADB keyboards, the Apple Keyboard and the Apple Extended Keyboard. Both keyboards connect to the Apple DeskTop Bus port on the rear of the Macintosh II. Both keyboards have their own microprocessors, which are called Keyboard Microcontrollers. The keyboards operate asynchronously, issuing commands on the ADB and transmitting and receiving data to and from the ADB devices.

NuBus Interface

The Macintosh II has six expansion slots to support Apple standard peripherals and increase RAM size. Each expansion slot is a 96-pin DIN connector that uses the NuBus Interface to communicate with the system. The following are a few of the cards that will go into the NuBus slots:

- video card
- co-processor card
- extra RAM
- Ethernet™ (and other networks)
- add-on SCSI port card

The NuBus has three major states of communication with the Macintosh II system:

- **Processor to NuBus**, which is activated whenever the microprocessor generates a physical slot address. If a device responds, the data is transferred.
- **NuBus to Processor Bus**, which is for accesses to RAM, ROM, and I/O to and from NuBus. There are two control functions being performed for this process. One tracks the changes on NuBus, and the other lets the 68020 tell NuBus what to do next.
- **NuBus timeout**, which is required to prevent accesses to empty slots, which would result in hanging up the system.

Every NuBus card should contain a ROM that provides information to the operating system at startup. The ROM information ensures that drivers are properly installed and that the card is initialized and recognized by the system.

Power Control

The Macintosh II has a hardware-on/software-off circuit to control the power supply.

There are two power switches on the system: one on the rear of the Macintosh II, and a secondary power switch (the reset button) on the Apple DeskTop Bus keyboard.

The power-off function is under software control. It allows the computer to clean up any pending activity before powering off. The power can be turned off by a menu selection or by the secondary power switch. If the software fails to turn off the machine, unplug it.

Video Interface Card

The Video Interface Card is a high-performance color graphics card based on a custom chip called Toby Frame Buffer controller (TFB). The card is capable of supporting any RS170-compatible monitor.

The Video Interface Card comes with 256K of video RAM installed. An expansion kit allows upgrading to 512K of RAM, allowing up to 256 colors or shades of gray to be displayed.

Power Supply

The power supply operates on standard line voltage and outputs +5v, +12v, and -12v DC voltages, which are used by the logic board, the internal devices, and the slots.

800K Internal Disk Drives

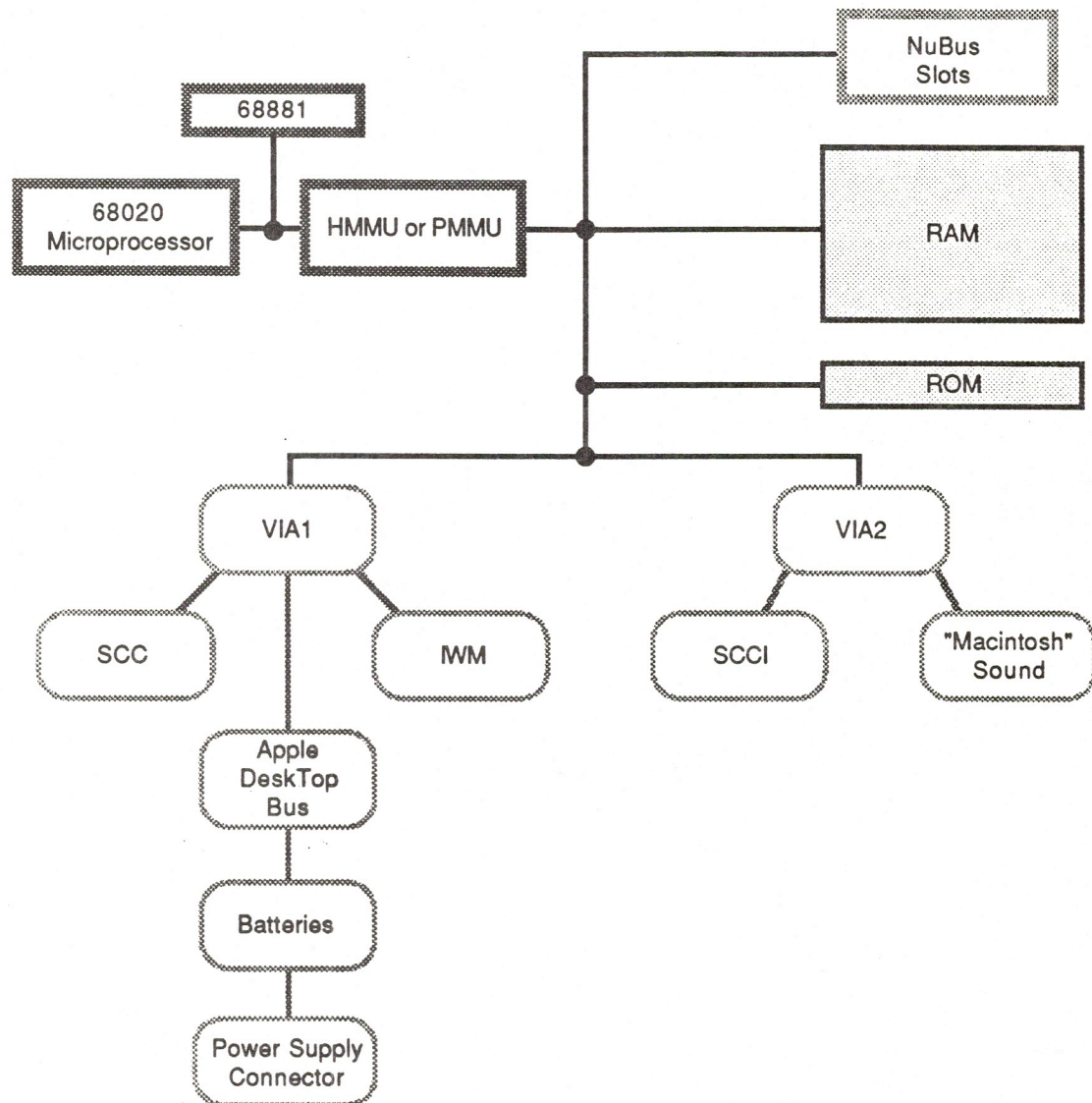
The internal 800K disk drive(s) connects to the main logic board through two internally installed connectors. The flow of data between the logic board and the disk drives is channeled through the IWM disk controller, which controls reading and writing operations.

Internal Hard Disk SCSI

The optional hard disk connects to the logic board through the internal SCSI connector. Other SCSI devices may be daisy chained to the external SCSI port.

Block Diagram

You now have a basic understanding of the components on the logic board. Below is a simplified block diagram of the information you have just read. Refer back to the appropriate component if you need to refresh your memory.



Macintosh II

Section 2 – Take-Apart

❏ CONTENTS

2.2	Electrostatic Discharge Prevention
2.2	Top Cover
2.4	Video Interface Card
2.5	Drive Mount
2.8	Disk Drives
2.10	Hard Disk SCSI
2.12	SIMMs
2.14	Logic Board
2.16	Power Supply

❑ ELECTROSTATIC DISCHARGE PREVENTION

The Macintosh II contains C-MOS components, and the Macintosh II RAM memory is installed on small separate boards called SIMM modules. Both the C-MOS and the SIMM modules are very susceptible to damage from electrostatic discharge (ESD).

Preventive measures must be taken to avoid ESD damage. When you are unwrapping, installing, or replacing any modules, observe the appropriate ESD precautions.

For complete ESD prevention information, refer to *You Oughta Know*, Section 6.

❑ TOP COVER

Materials Required

Phillips screwdriver

Remove

1. Remove the Phillips screw from the rear of the case (Figure 1, #1).
2. Locate the tabs on the rear of the machine (Figure 1, #2), one on each side.
3. Push the tabs in with your index fingers and lift the top cover, back first, from the machine. No force is necessary. (Do not push down on the top of the machine with your thumbs.)

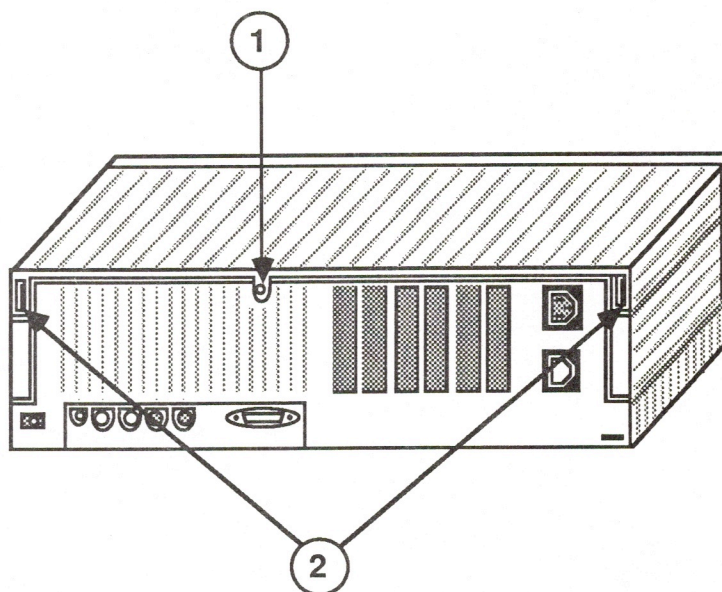


FIGURE 1

Replace

1. Position the top cover on the case, front first. Be sure to align the three notches on the front with the three tabs on the case.
2. Lower the top cover until the rear tabs snap into position.
3. Replace the Phillips screw (Figure 1, #1).

□ VIDEO INTERFACE CARD

The following procedure can be used for any card that is installed in the Macintosh II.

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover.
2. Remove the fastening screw (if present) that holds the card in place. Put the screw where it will not get lost.
3. Grasp the card by the upper edges and remove it. Gently tilt the board forward and back while pulling upward, putting the least possible stress on the logic board.

Replace

1. Remove the fastening screw on the strip behind the expansion slot you intend to use, and push the plastic cover out of the hole.
2. Gently position the card over the slot so that the hood on the bottom of the card lines up with the slot. The screw holder at the top of the card should line up with the screw hole on the computer.
3. Push down on the card, and gently tilt the board forward and back until it is sitting securely in the slot. Avoid putting excess stress on the logic board.
4. Replace the fastening screw to hold the card in place.
5. Replace the top cover.

□ DRIVE MOUNT

The drive mount is a metal frame that has the disk drives installed on it. The drive mount is then installed into the case of the Macintosh II.

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover and then the video card (and any other cards installed).
2. Remove the four Phillips screws that hold the drive mount in position (Figure 2, #1).

Note: The drives in the machine will vary depending on the customer's configuration. Disregard the instructions that do not apply to the system you are working on.

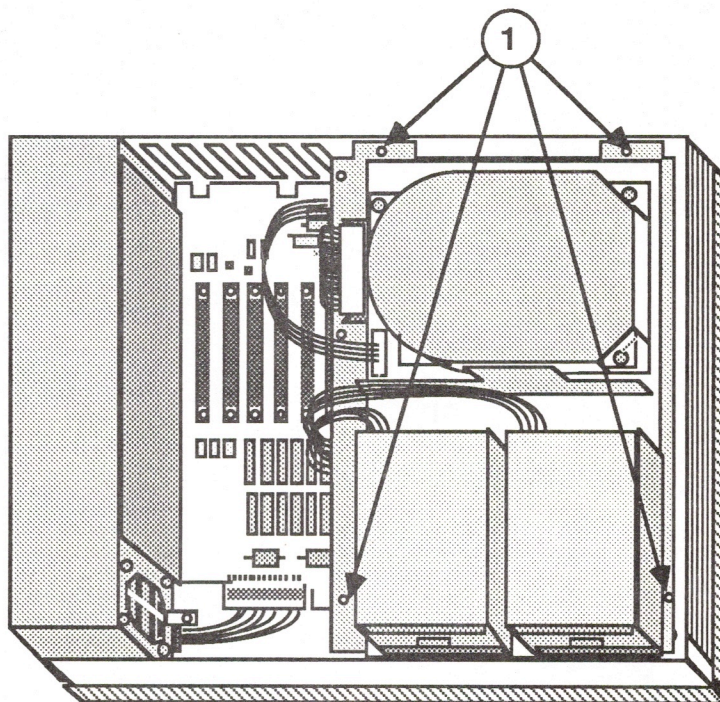


FIGURE 2

3. Disconnect the drive cables. Disconnect the cable from disk drive 1 (Figure 3, #1). Disconnect the cable from disk drive 2 (Figure 3, #2).
4. Disconnect the power connector that runs to the SCSI hard disk (Figure 3, #3).
5. Disconnect the SCSI hard disk cable from the hard disk (Figure 3, #4).
6. Remove the drive mount plate.

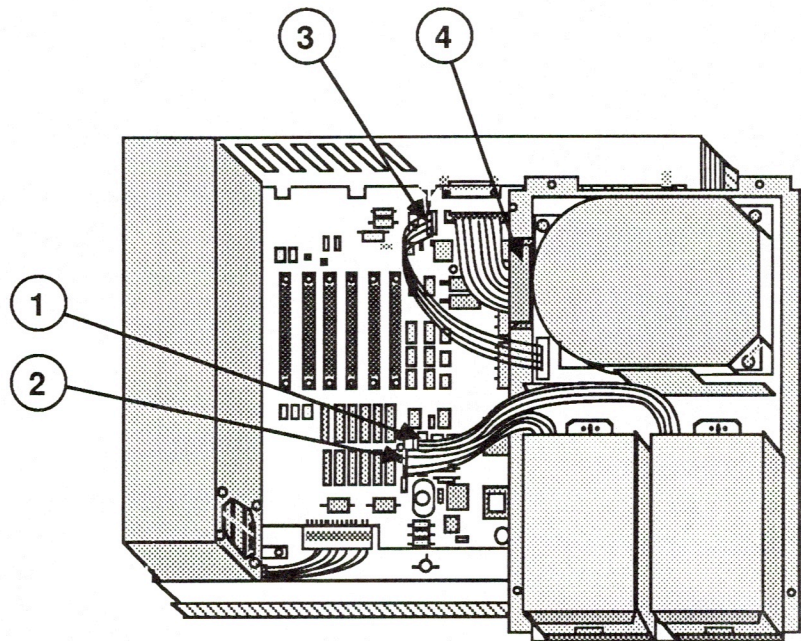


FIGURE 3

Replace

1. Position the drive mount plate so that the screw holes line up with the holes on the case.

Note: The drives in the machine will vary depending on the customer's configuration. Disregard the instructions that do not apply to the system you are working on.

2. Connect the power connector that runs to the SCSI hard disk (Figure 3, #3).
3. Connect the SCSI hard disk cable to the hard disk (Figure 3, #4).
4. Connect the drive cables. Connect the cable from disk drive 1 (Figure 3, #1). Connect the cable from disk drive 2 (Figure 3, #2).
5. Replace the four Phillips screws that hold the drive mount in place (Figure 4, #1).
6. Replace the video card (and any other cards installed) and then the top cover.

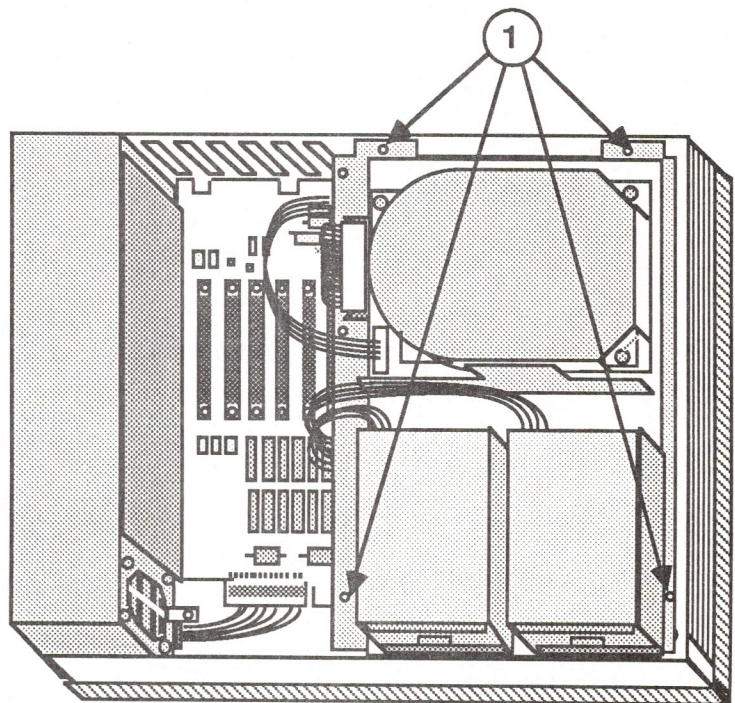


FIGURE 4

□ DISK DRIVES

The Macintosh II can have two internal disk drives. Drive 1 is located on the right side of the drive mount; its cable is connected to J16 (Figure 5, #1). Drive 2 is located on the left side of the drive mount; its cable is connected to J17 (Figure 5, #2).

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover and then the video card (and any other cards installed).
2. Remove the drive mount.

3. Remove the screw holding the appropriate drive in position:

For disk drive 1, see Figure 6, #1.

For disk drive 2, see Figure 6, #2.

4. Lift the rear of the drive, slide it back, and lift it off the drive mount.

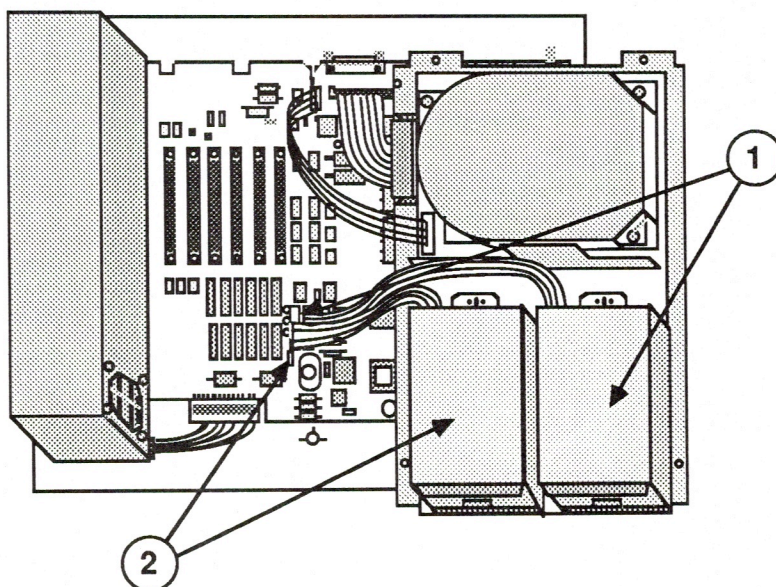


FIGURE 5

Replace

1. Position the front of the drive so that the two tabs on the drive case slide into the two holes on the drive mount. Lower the drive into position, making sure that the screw holes line up.
2. Remove the screw holding the appropriate drive in position:

For disk drive 1, see Figure 6, #1.

For disk drive 2, see Figure 6, #2.

3. Replace the drive mount.
4. Replace the video card (and any other cards installed) and then the top cover.

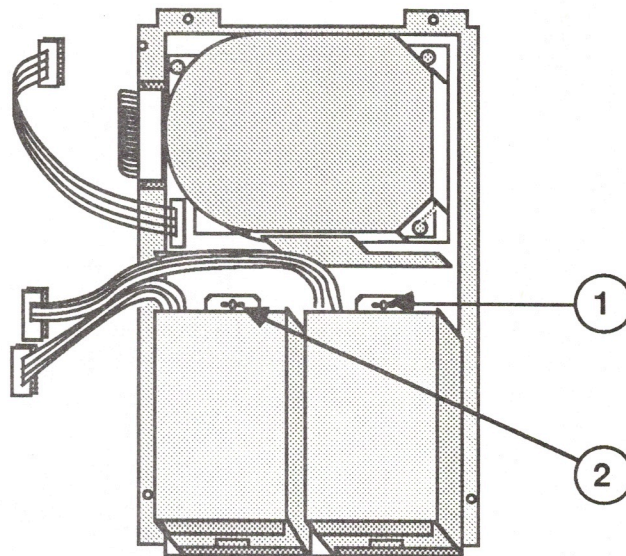


FIGURE 6

□ HARD DISK SCSI

Refer to Section 6, Additional Procedures, for more information on the Hard Disk SCSI.

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover and then the video card (and any other cards installed).
2. Remove the drive mount.

3. Remove the two Phillips screws holding the hard disk in position:

For the 5.25-inch Hard Disk SCSI, see Figure 7, #1.

For the 3.5-inch Hard Disk SCSI, see Figure 8, #1.

4. Lift the hard disk from the side with the cable connector, slide it back, and lift it off the drive mount.

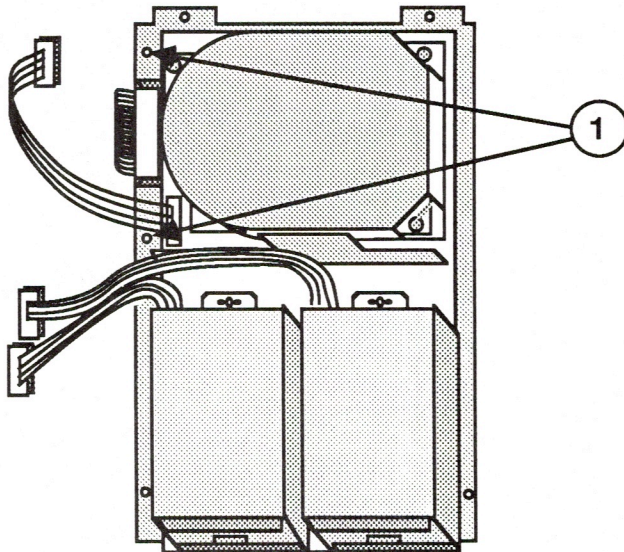


FIGURE 7

Replace

1. Position the front of the hard disk so that the two tabs on the hard disk case slide into the two holes on the drive mount. Lower the hard disk into position, making sure that the screw holes line up.
2. Replace the two Phillips screws holding the hard disk in position:

For the 5.25-inch Hard Disk SCSI, see Figure 7, #1.

For the 3.5-inch Hard Disk SCSI, see Figure 8, #1.

3. Replace the drive mount.
4. Replace the video card (and any other cards installed) and then the top cover.

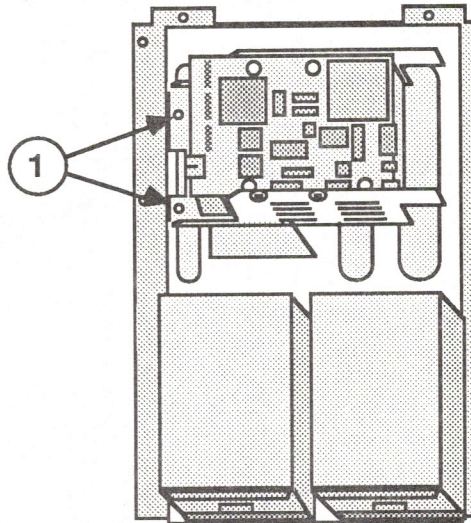


FIGURE 8

□ SIMMs

For identification of the two types of SIMMs and the various configurations available, refer to Section 6, Additional Procedures.

There are eight sockets available for SIMMs on the Macintosh II logic board (Figure 9, #1). The configurations that **do not work** are one single SIMM or two SIMMs of different sizes.

CAUTION: *SIMMs are very susceptible to damage from ESD and skin acid. Handle them only by the edges!*

Materials Required

Grounded workbench pad and wriststrap

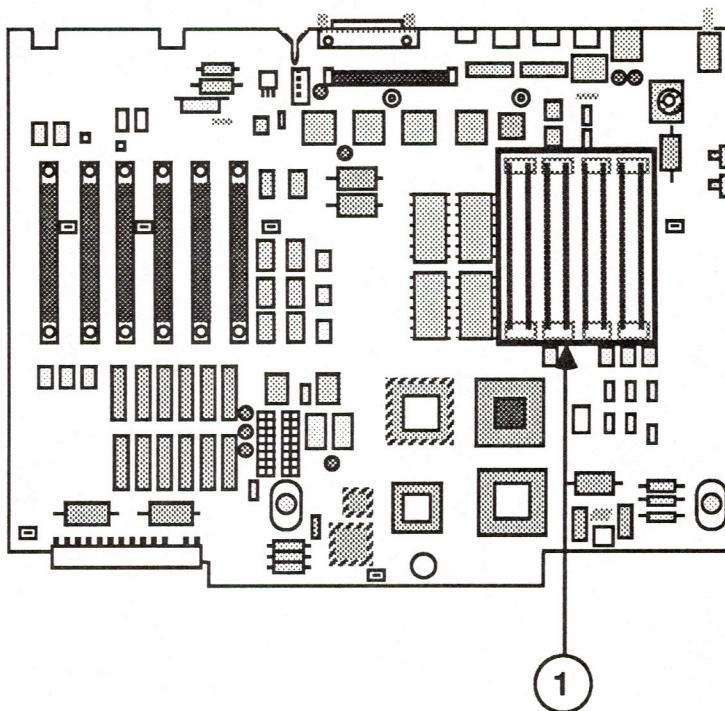


FIGURE 9

Remove

1. Remove the top cover and then the drive mount.
2. To remove a SIMM, push outward on the plastic holders (Figure 10, #1) at the ends of the SIMM until you hear a click. Then lift out the SIMM.

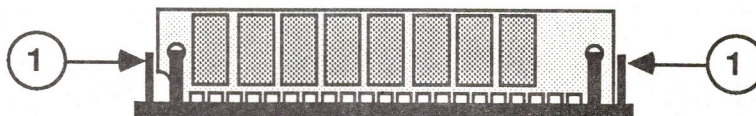


FIGURE 10

Replace

1. With the contacts (Figure 11, #1) on the SIMM pointing down, set the SIMM into the connector at an angle. Push back on the top corners of the SIMM. You will hear a click when the SIMM snaps into place.
2. Replace the drive mount and then the top cover.

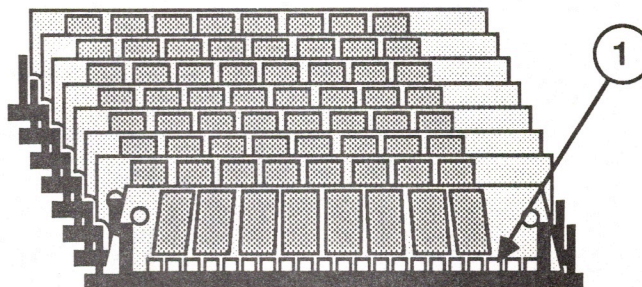


FIGURE 11

❑ LOGIC BOARD

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover and then the video card (and any other cards installed).
2. Remove the drive mount.
3. Remove the two screws that hold the logic board in place (Figure 12, #1).
4. Starting at the front of the logic board, gently lift up the board as you push each of the six tabs, one at a time (Figure 13, #1).
5. Slide the logic board toward you and lift it from the case.

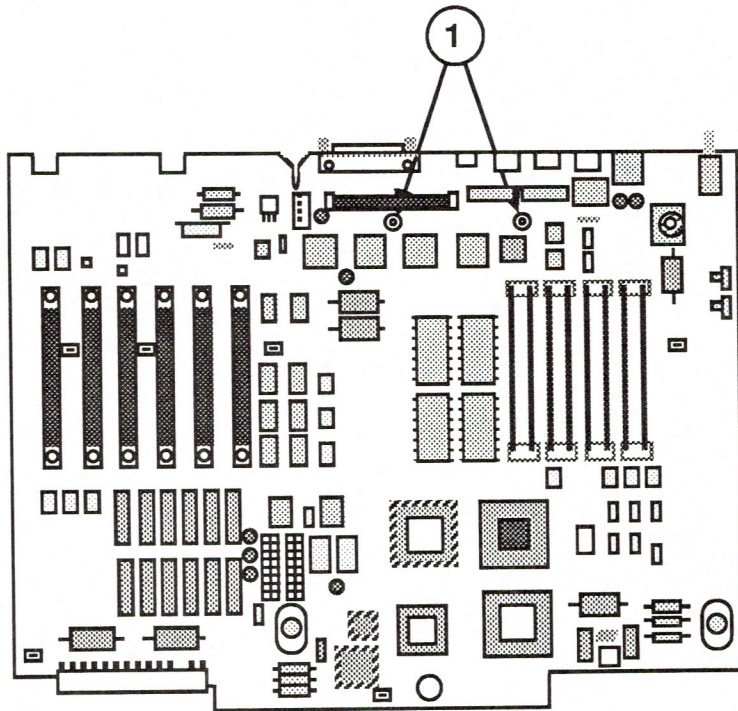


FIGURE 12

Replace

1. Position the logic board so that the port connectors on the rear are correctly positioned.
2. Gently lower the board into the case and press it onto the tabs (Figure 13, #1).
3. Replace the two screws (Figure 12, #1).
4. Replace the drive mount.
5. Replace the video card (and any other cards installed) and then the top cover.

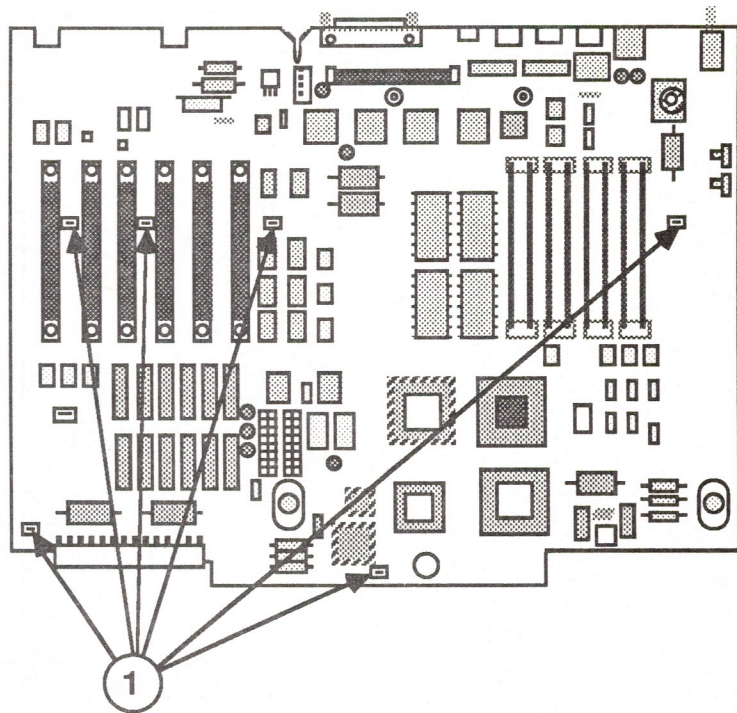


FIGURE 13

□ POWER SUPPLY

Materials Required

Phillips screwdriver

Remove

1. Remove the top cover, and then the video card (and any other cards installed).
2. Disconnect the power supply cable from the logic board (Figure 14, #1). If necessary, use a small flatblade screwdriver to pry the cable loose.
3. Remove the Phillips screw that holds the power supply in place (Figure 14, #2).
4. Lift the power supply, front first, from the case.

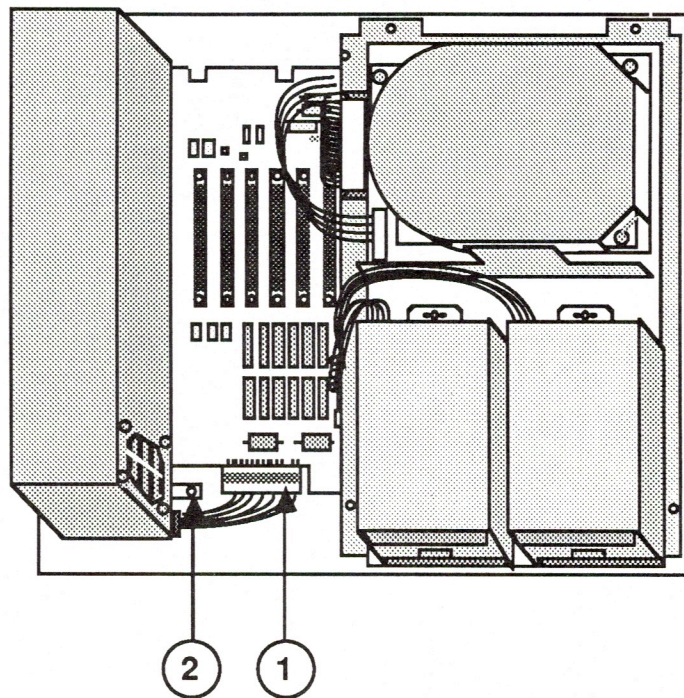


FIGURE 14

Replace

1. Position the power supply so that the AC connectors align with the holes in the rear of the case and so that the screw tab on the power supply aligns with the case.
2. Replace the Phillips screw that holds the power supply in place (Figure 14, #2).
3. Connect the power supply cable to the logic board (Figure 14, #1).
4. Replace the video card (and any other cards installed) and then the top cover.

Macintosh II

Section 3 – Diagnostics

□ CONTENTS

3.2	Introduction
3.3	MacTest Copy Program
3.3	Making a Backup Diskette
3.4	Materials Required
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3.6	Using Your Backup Diskette
3.7	Running <i>MacTest II</i>
3.7	What If...
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3.7	Installing the Loopbacks
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3.11	Running the Tests
3.13	Diagnostic Sound Sampler
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3.14	To Determine If a Jumper Is Needed
3.15	To Install the Jumper

□ INTRODUCTION

The *MacTest II* diskette tests the Macintosh II main logic board, internal floppy disk drives, video interface card, and SCSI bus. It also provides grid displays for use in adjusting the high-resolution monitors.

Note: *MacTest II* does not test the internal SCSI hard disk. To test the hard disk, use the *Macintosh Hard Disk Drive Diagnostic* diskette (see Section 3, Diagnostics, in the *SCSI Hard Disk Drives Technical Procedures*).

MacTest II is a pass/fail confidence test. As the test progresses, messages on the screen indicate which area is under test. As soon as a failure is detected, the test stops and the screen indicates which module must be replaced before the test can be completed.

The *MacTest II* diskette also contains the **MacTest Copy Program** and the **Diagnostic Sound Sampler**.

- The **MacTest Copy Program** works on the Macintosh Plus, Macintosh SE, or Macintosh II. **This program must be used to make all backup copies of the various *MacTest* diskettes.**
- The **Diagnostic Sound Sampler** lets you listen to the various musical chord sequences that are generated during a power-on failure.

□ MACTEST COPY PROGRAM

Making a Backup Diskette

Make a backup diskette before you begin! When testing a defective Macintosh II, it is possible to damage or erase a section of the *MacTest II* diskette.

Use the MacTest Copy Program on the *MacTest II* diskette to make all backup copies of the various *MacTest* diskettes. Features of the program that you should be aware of include the following:

- **You can make backup copies on any Macintosh,** regardless of which *MacTest* program you are copying. For example, you can copy the *MacTest II* diskette using a Macintosh Plus or a Macintosh SE. The copy does not have to be made on the Macintosh II.
- **You can make a copy using a single disk drive system.** Just select the same drive for both the **Source** and **Destination**; then follow the instructions given on the screen.
- **You can easily and quickly make multiple copies if enough memory is available. Same Source** automatically becomes highlighted and selected, which means that the program will keep prompting you for diskettes to copy to until you select **New Source** or **Quit** from the **File** menu. This will only happen, however, if the entire contents of the source diskette can be duplicated and stored in the system's memory.
- **You can switch to a New Source diskette.** This option is only available if **Same Source** automatically is selected.

Note: Do not access any desk accessories when using the **Same Source** selection.

Make a valid, working copy of your *MacTest II* diskette by using the following procedure.

Materials Required

Macintosh Plus, SE, or II
800K external drive (recommended) for the Macintosh Plus or SE
MacTest Copy Program, contained on the *MacTest II* diskette
Blank 800K diskette

Backup Procedure

1. Set up the system you will be using to make copies.
2. Insert the *MacTest II* master diskette into drive one (right), and power on the system.

Note: An error message will appear if you are using anything other than a Macintosh II. It will warn you that this computer is not a Macintosh II and that this test works only with a Macintosh II. **Ignore the message** and click on **OK**. The desktop will appear.

3. Open the **MacTest Copy Program** icon.
 - The **Source Drive** should have the original diskette installed.
 - The **Destination Drive** should have a blank diskette installed.

Note: The drive configuration for the Macintosh Plus or the Macintosh SE is reflected under **Source** and **Destination** in the window.

The following window will appear if you are using a Macintosh II.

MacTest™ Disk Copy Program

	Source Drive	Destination Drive
<input type="radio"/> Same Source	<input checked="" type="radio"/> Right	<input type="radio"/> Right
<input type="radio"/> New Source	<input type="radio"/> Left	<input checked="" type="radio"/> Left

Tracks read

Tracks written

Comments:

Insert write-protected source disk in right drive
Insert write-enabled destination disk in left drive

STOP

4. Follow the instructions on the screen to make a copy.

5. Upon completion, you have two choices:

a) If you wish to make additional copies:

1) Follow the instructions on the screen.

The program will make another copy.

2) Repeat this process until you have the number of copies you need.

b) If you wish to quit making copies:

1) Pull down the **File** menu and select **Quit**.

2) Insert the *MacTest II* diskette, as instructed in the dialog box.

The desktop will return.

You now have a copy of the *MacTest II* diskette. Place the original in a safe place.

Using Your Backup Diskette

Take the following precautions when using your *MacTest II* diskette copy:

- **Use the MacTest Copy Program for making all backup copies of MacTest diskettes.** If you do not, the copy will not work correctly.
- **Do not write-protect your working copy of the MacTest II diskette.** The program will not run correctly if you do.
- **Do not replace the system or finder provided on the MacTest II diskette.** The versions used on the diskette are Finder 5.4 and System 4.1. *MacTest II* is not guaranteed to work with other versions.
- **Do not change the name of the diagnostic program on the diskette.** During logic board testing, the machine reboots, looks for, and restarts the diagnostic named *MacTest II*. If the name has been changed, the startup routine will not be able to locate it, and the system will stay on the desktop.

Therefore, if the *MacTest II* window does not reappear after a logic board test, check the name of the diagnostic's icon on the desktop. Correct it to *MacTest II*, then select **Set Startup** from the desktop **Special** menu. When you are asked if you wish to change the name of the startup application to *MacTest II*, click **OK**. Then double-click on the corrected *MacTest II* icon to return to the test program.

□ RUNNING MACTEST II

What if...

If any of the following problems are encountered, refer to Section 4, Troubleshooting, for additional information.

- The known-good *MacTest II* diskette will not boot.
- The **Configuration** window indicates there is no interface card installed in any slot, and there is.
- The **Configuration** window indicates there are no disk drives installed, and there are.
- The Macintosh II system intermittently locks up during the logic test.
- The **Configuration** window indicates the wrong amount of RAM installed.

Materials Required

MacTest II diagnostic diskette (backup)
Mini DIN-8 to mini DIN-8 Serial Port Cable
SCSI Loopback Test Card (modified with jumper—see "SCSI Loopback Jumper Procedure")
Blank formatted 800K diskette for left drive test, if left drive is installed

Installing the Loopbacks

Before beginning *MacTest II*, and **with the power off**, connect the serial loopback cable, the SCSI loopback card, the keyboard, the mouse, the video interface card, and the monitor.

CAUTION: *Always power off the system when you connect or disconnect the SCSI loopback card.*

The SCSI loopback card cable must be connected to the SCSI port on the back of the Macintosh II. (No other connections between the card and the Macintosh II are necessary.) To protect the SCSI circuitry, you must have the power off when you connect the SCSI card. The loopback cable with the mini DIN-8 connectors must be installed between the two serial ports on the rear of the machine.

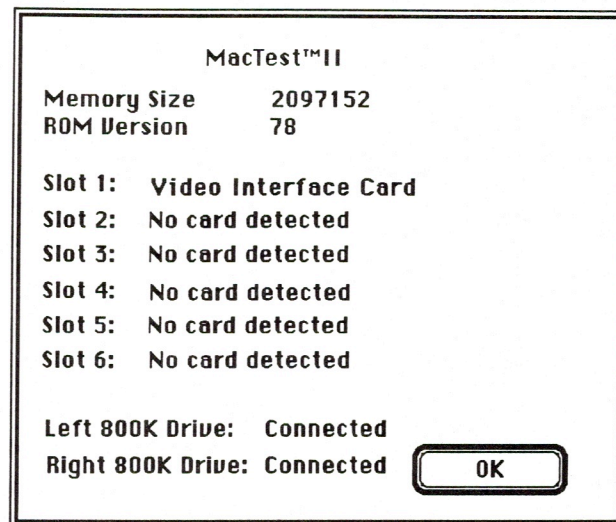
Using the *MacTest II* Menus

Insert the *MacTest II* diskette into the internal drive, and power on the system. The *MacTest II* test window will appear. The menus available from the *MacTest II* window are described below.

Options Menu

The **Options** menu contains two submenu choices:

1. **Configuration:** The following window will appear when Configuration is selected.



This window indicates the amount of memory, the version number of the ROMs, and the cards installed in slots 1 through 6 in the Macintosh II under test.

2. **Test Selections:** The following window will appear when Test Selections is selected.

<input checked="" type="checkbox"/> Logic test	<input checked="" type="checkbox"/> Video card in slot <input type="text" value="1"/>
<input checked="" type="radio"/> Short <input type="radio"/> Long	<input checked="" type="checkbox"/> Monitor
<input checked="" type="checkbox"/> 800K Drives	
<input type="checkbox"/> Left <input checked="" type="checkbox"/> Right	
<hr/>	
<input type="checkbox"/> Loop on all tests	<input type="button" value="OK"/> <input type="button" value="Cancel"/>

- a) **Logic:** This test verifies the correct functioning of the following circuitry on the board:

- VIA (Versatile Interface Adaptor)
- Serial ports
- Clock
- SCSI bus
- Memory (RAM)

You may select a short or long logic test. The running time of these tests will vary depending on the memory size of the system. **You will need to keep track of the amount of time it is taking to run the RAM test, because there is no moving or flashing indicator that the system is running.** The approximate times for the various memory configurations are given below.

<u>Memory Size</u>	<u>Short</u>	<u>Long</u>
1M	2-minutes	12-minutes
2M	4-minutes	25-minutes
4M	8-minutes	50-minutes
5M	10-minutes	62-minutes
8M	16-minutes	100-minutes

b) **800K Drives:** You may test any or all of the drives (except hard disk drives):

- Right (one)
- Left (two)

c) **Video Card:** You must enter the slot that the card is installed in.

The **Monitor** selection provides three test patterns: a grid, a white screen, and color or gray bars.

Note: Refer to *Apple High-Res Monochrome Monitor Technical Procedures* or *Apple-High Res RGB Monitor Technical Procedures* for information about any necessary adjustments.

d) **Loop on all tests:** This selection provides continuous running (in sequence) of all selected tests except the **Monitor**. To stop the looping, click the **Stop** box between tests (that is, when the screen displays an arrow rather than a wristwatch).

To select a test, click in the box next to the name of the item to be tested. The box will display an X. To deselect the test, click again in the box to remove the X. When you have selected all the tests you wish, click in the **OK** box. You will be returned to the *MacTest II* window.

File Menu

The **File** menu allows you two choices:

1. **Save Test Selections:** Allows you to customize your *MacTest II* diskette by saving your selection of tests for the next time you use *MacTest II*. The default configuration is the short logic test and right (one) drive test.

IMPORTANT: *The diskette must be write-enabled before you save your selections.*

2. **Quit:** Returns you to the desktop.

Apple Menu

The Apple (🍏) menu allows you to access the **Key Caps** desk accessory to check the operation of the Apple DeskTop Bus keyboard. When selected, **Key Caps** displays a window with a keyboard. Press each key on the keyboard and verify that the display block for that key is highlighted. If the key is not highlighted, the keyswitch is bad and the keyswitch should be replaced. If numerous keys are not highlighted, exchange the keyboard.

Running the Tests

After you have used the **Test Selections** window to specify the tests you wish to run, you are ready to start *MacTest II*. Click on the **Start** box in the *MacTest II* window. The testing will begin. Please note the following:

- The **Status** line at the bottom of the *MacTest II* screen will keep you informed of the tests being performed and their results.
- While running, the memory test displays a wristwatch. There is no other moving or flashing indicator that tells you the test is in progress. Check the amount of RAM installed on the logic board, and keep track of the time that the RAM test is running. If it takes too long, the machine has locked up.
- If the SCSI loopback card is missing or improperly installed, you will be instructed at once to turn off the power, disconnect all external SCSI drives, and connect the SCSI loopback card.
- If the serial loopback cable is missing or improperly installed, the testing will begin, but the serial ports test will fail. You will be instructed to make sure the serial loopback cable is connected, then to click on **Continue** to retry the failed test. (You can connect the serial loopback cable without powering off the system.)

- You may halt the testing by clicking on **Stop** or **Pause** any time between tests (that is, when the screen displays an arrow rather than a wristwatch).
 - Choose **Stop** to halt the testing and to return to the **Waiting for Start** state. Choose **Start** when you wish to begin the testing sequence again.
 - Choose **Pause** if you wish to discontinue testing temporarily. Choose **Continue** to resume the tests from the point of interruption.

Replace any module that the test indicates is faulty. Then run *MacTest II* again to make sure the problem has been corrected. If the system is still not operating properly, turn to Section 4, Troubleshooting, for more information.

If all tests pass, the Macintosh II will return to the *MacTest II* window. The message **All tests have passed.** **Waiting for Start** will be displayed on the **Status** line.

□ DIAGNOSTIC SOUND SAMPLER

Introduction

The **Diagnostic Sound Sampler** enables you to listen and become familiar with the Macintosh II error chords. Error chords are brief, musical tones that indicate whether the system is functioning correctly or if there is a hardware problem.

Refer to Section 4, Troubleshooting, for complete information on startup and error chords.

Materials Required

Known-good Macintosh II system
MacTest II diskette (backup)

1. Set up the Macintosh II system.
2. Insert the *MacTest II* backup diskette. A window will appear telling you to connect a SCSI loopback card.
3. Click **OK**. The desktop will appear.
4. Open the **Diagnostic Sound Sampler**. A window listing the various chords and chord sequences will be displayed. Select the ones you wish to hear.
5. On completion, click **Quit**.

❑ SCSI LOOPBACK JUMPER PROCEDURE

To Determine If a Jumper Is Needed

To be used with *MacTest II*, the SCSI loopback card must be jumpered between Pin 25 of J1 and Pin 14 of RP1. On new SCSI loopback cards, the jumper has been etched into the printed circuit. Only cards with the old PCB artwork need the jumper procedure.

Note: This modification does not interfere with the card's use on other Macintosh or Apple II family systems, except that to work on Apple II systems it must be connected to a notched mouse cable. (For further information on the notched cable, refer to *SCSI Hard Disk Drives Technical Procedures*, Appendix A, "SCSI Interface Card.")

To Identify a New Card

To determine if you have a new card, which will not need to be jumpered, look at the back of the card. If the jumper is included in the artwork, there will be an **A** instead of double zeros (00) at the end of the part number, which is located under the words "APPLE COMPUTER" (Figure 1, #1). **These new cards do not have to be jumpered.**

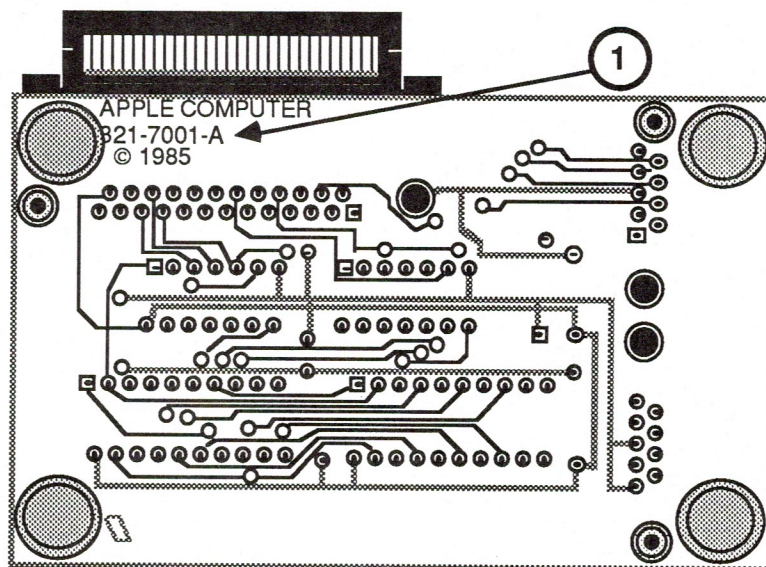


FIGURE 1

External Jumpers on Old Cards

Some cards with the **00** part number and the old artwork were modified with an external jumper during the manufacturing process. Therefore, if your card has a **00** part number, check to see if it has an external jumper from Pin 25 of J1 to Pin 14 of RP1 (Figure 2, #1). If it has no external jumper, you must install one yourself.

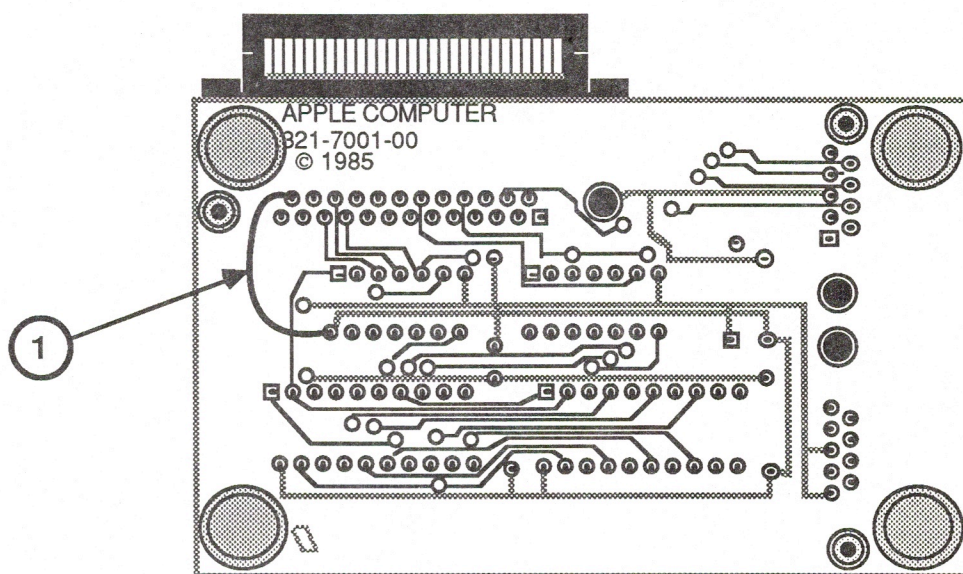


FIGURE 2

Summary

To summarize:

**If # on back
ends with:**

Do this:

A

Nothing
(Jumper is present in artwork.)

00

Check to see if external jumper
is present. If not, install jumper.

To Install the Jumper

If you find that the card must be jumpered, solder a wire connection between Pin 25 of J1 and Pin 14 of RP1, as shown in Figure 2. (The pins are not numbered on the board. In the orientation shown in Figure 2, Pin 25 is the pin closest to the upper left corner of the card, and Pin 14 is in the middle line of pins, closest to the left edge of the card.)

Macintosh II

Section 4 – Troubleshooting

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...Continued on next page

- 4.28 Battery Verification
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- 4.29 Verification Procedure
- 4.30 Customer's Configuration Chart

Note: If a step is underlined, instructions for that step can be found in Section 2, Take-Apart.

□ INTRODUCTION

General Information

There are two test diskettes that may be used to test portions of the Macintosh II system:

- *MacTest™ II*
- *Macintosh Hard Disk Drive Diagnostic* (version 4.0 or higher)

Use this troubleshooting section if you are unable to boot the *MacTest II* diskette or if the diskette is unable to detect a module failure. After you repair the system, run the test diskette again to verify system operation.

Before You Start

Read the sections entitled "Things To Remember," "Module Exchange Information," "Startup and Error Chords," "SIMM Verification," and "Battery Verification" before you begin troubleshooting. **You need the information provided in these sections to troubleshoot the Macintosh II effectively.**

Error Chords

The Macintosh II executes a ROM-based self-test when powered on. If any part of the self-test fails, a sequence of chords will sound. To hear a sample of each sequence of chords, listen to the "Diagnostic Sound Sampler" on the *MacTest II* diskette. (Refer to Section 3, Diagnostics, for more information.)

How to Use the Symptom Charts

First find the symptom that most nearly describes the problem; then perform the first corrective action on the solution list. If that corrective action does not fix the problem, go to the next one. **If you replace a module and find that the problem remains, reinstall the original module before you go on to the next action.**

If the symptoms displayed by the Macintosh II are not listed in the symptom charts, or if the system is not displaying a clearly defined problem, use the "Flow Chart" section.

How to Use the Troubleshooting Flow Charts

There are five numbered flow charts for the Macintosh II. On completion of Flow Chart 1, you will be instructed to continue to the next flow chart. You continue until you complete Flow Chart 5.

Each of the flow charts includes references to notes on the opposite page. These notes provide additional instructions or referrals to other procedures.

Starting at the top of Flow Chart 1, answer the questions and proceed down the chart. When you arrive at a rectangular box containing a list of actions, perform the actions in the sequence listed. On completion, return to the preceding diamond box. **If the problem remains, reinstall the original module before you go on to the next action.**

□ THINGS TO REMEMBER

ESD

1. Follow all electrostatic discharge (ESD) precautions when working on the Macintosh II. Refer to *You Oughta Know* in the *Apple Service Technical Procedures* for additional information.

Troubleshooting Hints

2. If available, use a known-good monitor and video interface card. This will isolate the problem to the CPU, internal drives, keyboard, and mouse.
3. Before you begin troubleshooting, remove all interface cards (except the video interface card), and disconnect any external devices (printers, SCSI devices, and/or ADB devices other than the keyboard and mouse).
4. Mark each known-good SIMM module on the exchange logic board with white correction fluid or a small sticker to prevent confusion during the troubleshooting procedure.
5. Use a known-good copy of the *MacTest II* diskette.

Normal Startup Tone

6. During a normal startup sequence, a medium-pitched soft chord is emitted; then a diskette with a flashing question mark is displayed on the screen. If either of these things does not happen, refer to "Startup and Error Chords" for additional information.

System Configuration

7. To ensure that the customer gets back the same system configuration that he brings in, record the following information:
 - Number of internal disk drives
 - If one is installed, the size of the SCSI hard disk (20M, 40M 80M)
 - SIMM sizes
 - Type of MMU

To make record keeping easier, you may want to copy the Customer's Configuration Chart provided later in this section.

System Software

8. Verify that the customer is using System 4.1 and Finder 5.4 (or higher). Using the wrong versions may destroy data.

Logic-Board-Only Exchange

9. When instructed to replace the **logic board only**: Remove the SIMMs that are included on the replacement logic board; then place the **customer's SIMMs** on the **replacement logic board**.

□ MODULE EXCHANGE INFORMATION

Logic Board Configuration

The Macintosh II logic board service exchange module is shipped with the following components installed:

- 1M RAM (four 256K SIMMs)
- HMMU

To make sure the customer always gets back the same logic board configuration that he brought in, **be sure to record the following information before you exchange any modules:**

- The amount of memory installed and the size of the SIMMs.
- Which type of Memory Management Unit is installed: the HMMU (standard) or the PMMU, which is a 68851 IC (upgrade).

At the end of this section there is a form you can use to record the customer's system configuration. Feel free to copy it for your own use.

Internal Hard Disk SCSI

The internal 20M, 40M, and 80M SCSI hard disks are shipped without the SCSI cable connected. **Be sure to keep the SCSI cables with the customer's Macintosh II system.** They are sold as a separate replacement part and are not part of any module.

The SCSI power cable is included with all the internal SCSI drive modules.

□ STARTUP AND ERROR CHORDS

Introduction

When the Macintosh II is powered on, the ROM executes a self-test. If any part of the self-test fails, a sequence of chords will sound. To hear a sample of each sequence of chords, listen to the "Diagnostic Sound Sampler," which is included on the *MacTest II* diskette. (Refer to Section 3, Diagnostics, for more information.)

If you are unable to interpret the chords, use the flow charts and ignore the question about the startup chord on Flow Chart 1.

Startup Chord

During a normal startup sequence, a medium-pitched chord is emitted; then a diskette icon with a flashing question mark is displayed on the screen.

Error Chords

If a startup chord and additional chords sound, a blank gray screen will usually be displayed. There will always be three sequences played if an error is encountered during startup: startup chord, error chord, and test monitor chord.

Refer to the list of failure areas below, which includes a description of each error chord, the problem it indicates, and what to do to correct the problem.

Initial Failure

A short, harsh chord indicates a failure during the initial hardware self-tests. To correct the problem:

1. Exchange the logic board. (Install the customer's SIMM modules on the exchange board. Be sure you have marked the known-good SIMMs that you removed from the exchange logic board.)
2. If this doesn't work, use the customer's logic board and exchange the SIMMs only. (Refer to "SIMM Verification" in this section for complete instructions.)

If the system still does not work, you will need to verify the customer's SIMMs on the exchange logic board. (Refer to "SIMM Verification" in this section for complete instructions.)

RAM 1 and 2 Failure

A long, medium-pitched chord (RAM 1) or a medium-pitched then high chord (RAM 2) indicates a RAM self-test failure. To correct the problem:

1. Exchange only the SIMMs in Bank A. (Refer to "SIMM Verification" in this section for complete instructions.)
2. Exchange only the SIMMs in Bank B. (Refer to "SIMM Verification" in this section for complete instructions.)
3. If these exchanges do not work, exchange the logic board. (Install the customer's SIMM modules on the exchange board.)
4. If the system still does not work, you will need to do the SIMM verification with the exchange logic board.

Test Monitor

Four chords (from low to high) indicate that the system has entered the test monitor.

Summary

The following chart summarizes all the preceding information on error chords. The left column lists the chords, and the right column lists the actions to be taken.

Chord Sequences

Actions

- | | |
|---|--|
| <ul style="list-style-type: none">• <i>Startup, Initial, Test Monitor</i> | <ol style="list-style-type: none">1. Replace logic board only.2. Perform SIMM verification on customer's logic board. |
| <ul style="list-style-type: none">• <i>Startup, RAM 1, Test Monitor</i> | <ol style="list-style-type: none">1. Perform SIMM verification of Bank A then of Bank B on customer's logic board.2. Replace logic board only.3. Perform SIMM verification on a replacement logic board. |
| <ul style="list-style-type: none">• <i>Startup, RAM 2, Test Monitor</i> | <ol style="list-style-type: none">1. Perform SIMM verification of Bank A then of Bank B on customer's logic board.2. Replace logic board only.3. Perform SIMM verification on replacement logic board. |

❑ SYMPTOM CHART

Video Problems

Solutions

- *Screen is dark, audio and drive operate, fan is running, and LED is lit*
 1. Adjust brightness on monitor.
 2. Replace monitor.
 3. Replace video cable.
 4. Move video interface to a different slot.
 5. Replace video interface card (refer to Section 5, Additional Procedures).
 6. Replace SIMMs (refer to "SIMM Verification").
 7. Replace logic board.
 8. Replace power supply.

- *Screen dark, no audio, no drive, but fan is running and LED is lit*
 1. Replace video cable.
 2. Move video interface to a different slot.
 3. Replace video interface card (refer to Section 5, Additional Procedures).
 4. Replace SIMMs (refer to "SIMM Verification").
 5. Replace logic board.
 6. Replace power supply.
 7. Replace monitor.

- *Partial or whole screen is bright and audio is present, but no video information is visible*
 1. Replace monitor.
 2. Replace video cable.
 3. Move video interface to a different slot.
 4. Replace video interface card (refer to Section 5, Additional Procedures).
 5. Replace logic board only.

- *Screen is completely dark, fan is not running, and LED is not lit*
 1. Plug the monitor directly into the wall socket, and verify that the monitor has power.
 2. Check batteries (refer to "Battery Verification").
 3. Replace power supply.
 4. Replace logic board only.

Note: If replacing the monitor will correct the problem, refer to the *Technical Procedures* to get replacement information.

Drive Problems

Solutions

- *Audio and video present, but one internal 800K drive does not operate*
 1. Replace bad diskette.
 2. Verify that all external SCSI devices are disconnected.
 3. Replace internal disk drive cable.
 4. Replace internal disk drive.
 5. Replace logic board only.
 6. Replace power supply.

- *Audio and video present but neither internal 800K drive operates*
 1. Replace bad diskette.
 2. Verify that all external SCSI devices are disconnected.
 3. Replace power supply.
 4. Replace logic board only.

- *Disk ejects; display shows icon with blinking "X"*
 1. Replace diskette with known-good system diskette.
 2. Replace internal disk drive cable.
 3. Replace internal disk drive.
 4. Replace logic board only.

- *Will not eject diskette*
 1. Power off system and hold mouse button down while powering on.
 2. Replace disk drive.

- *Attempts to eject diskette, but doesn't*
 1. Reinsert diskette.
 2. Reseat top cover so drive slots line up correctly.

- *Internal disk drive runs continuously*
 1. Replace bad diskette.
 2. Replace internal disk drive cable.
 3. Replace internal disk drive.
 4. Replace logic board only.

- *Internal hard disk will not operate*
 1. Replace SCSI cable connector.
 2. Replace SCSI power connector.
 3. Replace hard disk.
 4. Replace logic board only.

Peripheral Problems

Solutions

- *Cursor does not move*
 1. Check mouse connection.
 2. If mouse was connected to keyboard, connect it to a rear ADB port instead. If mouse works, keyboard should be replaced.
 3. If mouse does not work in any ADB port, replace mouse.
 4. Replace logic board only.
- *Cursor moves but clicking the mouse button has no effect*
 1. Replace mouse.
 2. Replace logic board only.
- *No response to any key on the keyboard*
 1. Check keyboard connection to ADB port.
 2. Replace keyboard cable.
 3. Replace keyboard.
 4. Replace logic board only.
- *Known-good ImageWriter or ImageWriter II will not print*
 1. Make sure System 4.1 and Finder 5.4 (or higher) are used.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Replace printer interface cable.
 4. Replace logic board only.
- *Known-good LaserWriter will not print*
 1. Make sure System 4.1 and Finder 5.4 (or higher) are used.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Refer to the *Networks* tab in the *Apple Technical Procedures* for more information.

Miscellaneous Problems

Solutions

- *Clicking, chirping, or thumping sound*
 1. Replace power supply.
 2. Replace logic board only.

- *System shuts down intermittently*
 1. Make sure air vents on sides and top of main unit are kept clear. Thermal protection circuitry may shut the system down. After 30 to 40 minutes the system should be OK.
 2. Replace power cable.
 3. Check batteries (refer to "Battery Verification").
 4. Replace power supply.
 5. Replace logic board only.

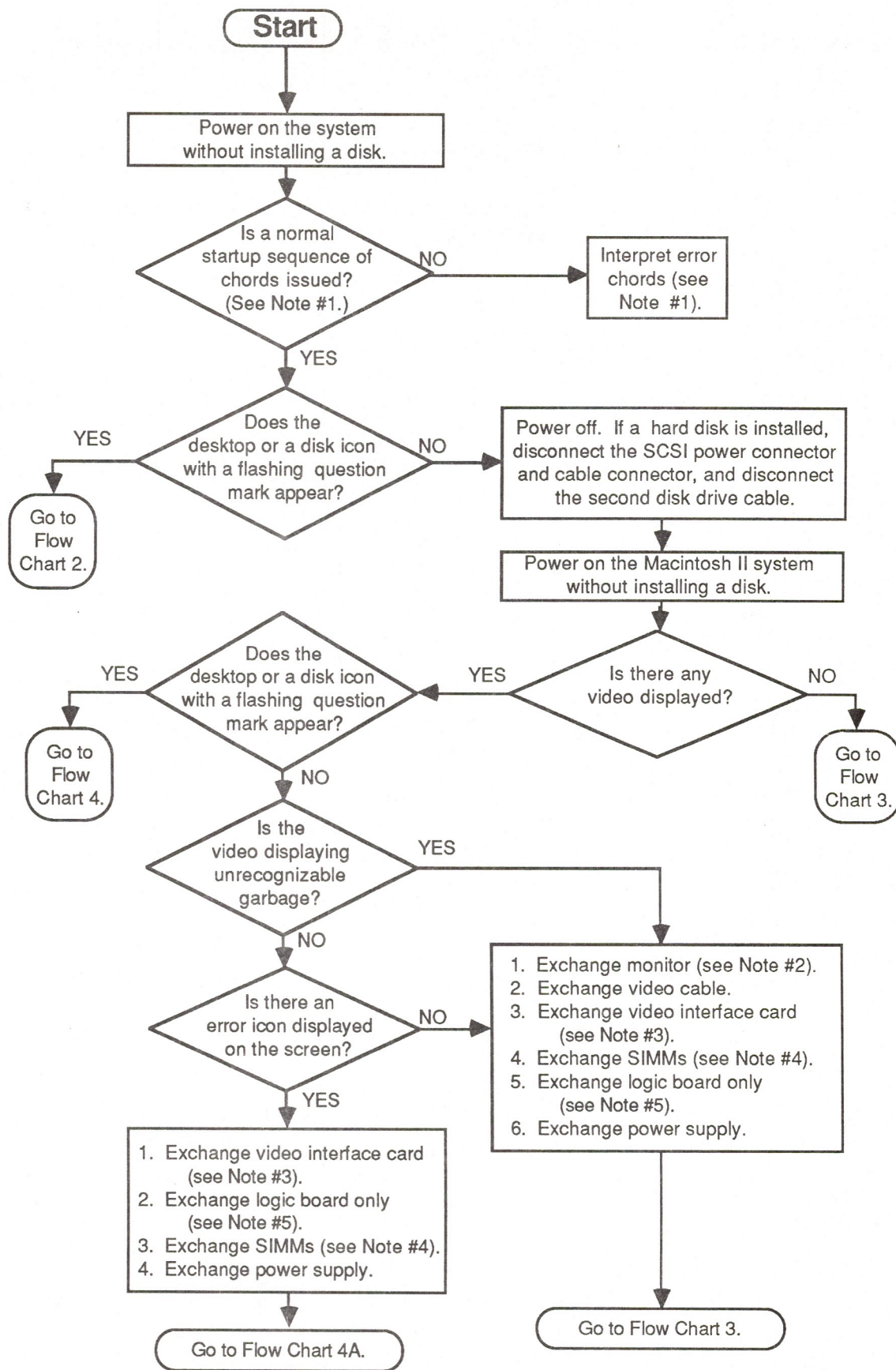
- *System intermittently crashes or locks up*
 1. Make sure System 4.1 and Finder 5.4 (or higher) are being used.
 2. Make sure software is known-good.
 3. Replace logic board only.
 4. Replace SIMMs (refer to "SIMM Verification").
 5. Replace power supply.

- *No sound from speaker*
 1. Verify that the volume setting in the Control Panel is set to one or above.
 2. Replace speaker.
 3. Replace logic board only.

□ MACINTOSH II FLOW CHARTS

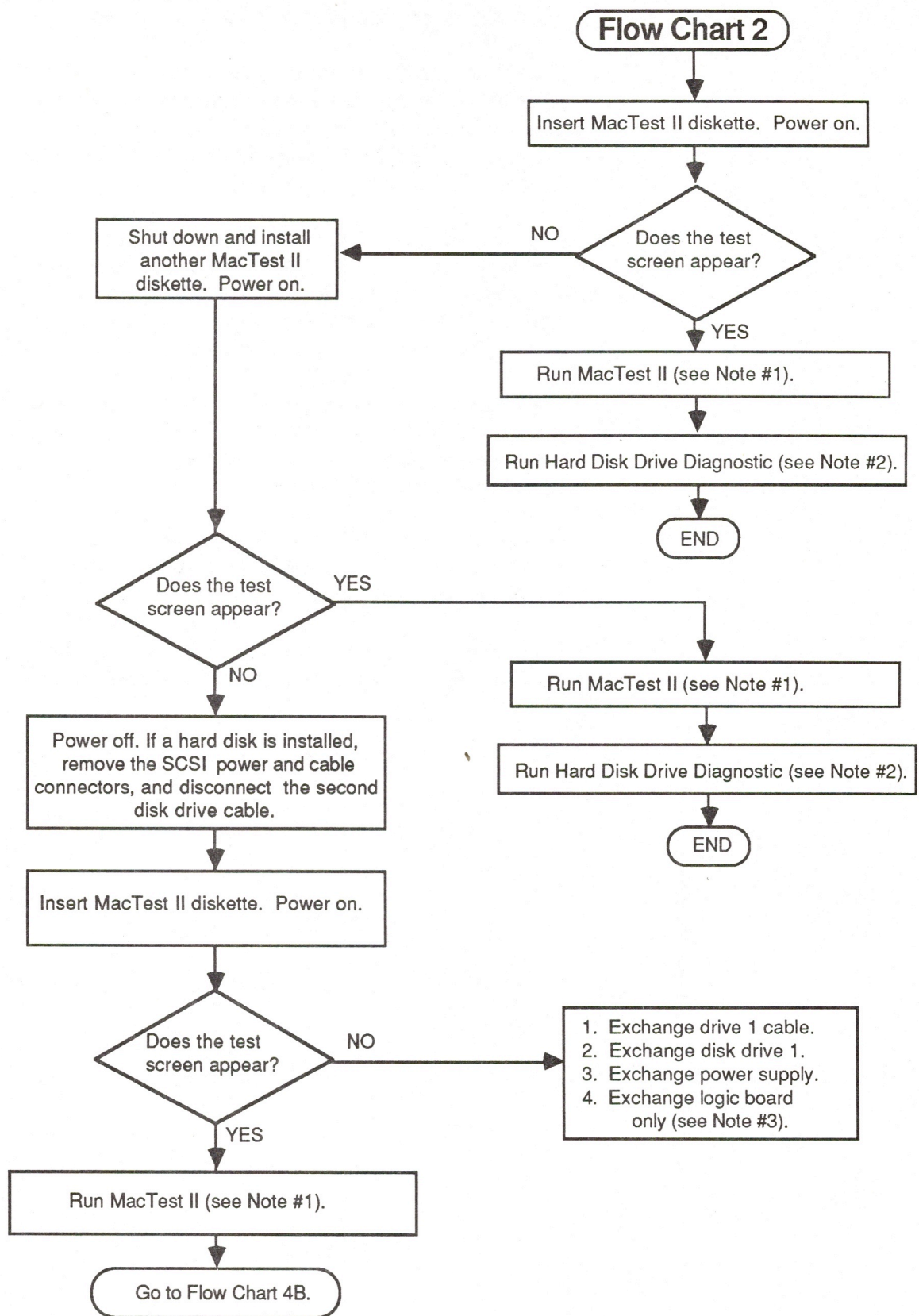
Flow Chart 1

1. During a normal startup sequence a medium-pitched soft chord is emitted; then a disk icon with a flashing question mark is displayed on the screen. If either of these things does not happen, refer to "Startup and Error Chords" for additional information. If you cannot interpret the chords, continue with the flow chart.
2. If exchanging the monitor will correct the problem, refer to the *Apple High-Res Monochrome Monitor Technical Procedures* or *Apple High-Res RGB Monitor Technical Procedures* to isolate the monitor problem to the module level.
3. If exchanging the video interface card corrects the problem, and if the customer's card has the video expansion kit installed, refer to Section 5, Additional Procedures, for information on troubleshooting the eight replaceable RAMs.
4. There are two steps to perform when exchanging the SIMM modules. Refer to "SIMM Verification" for complete instructions on verifying and troubleshooting the SIMMs.
5. If the known-good SIMMs did not correct the problem, install the **customer's SIMMs** on the **replacement logic board**.



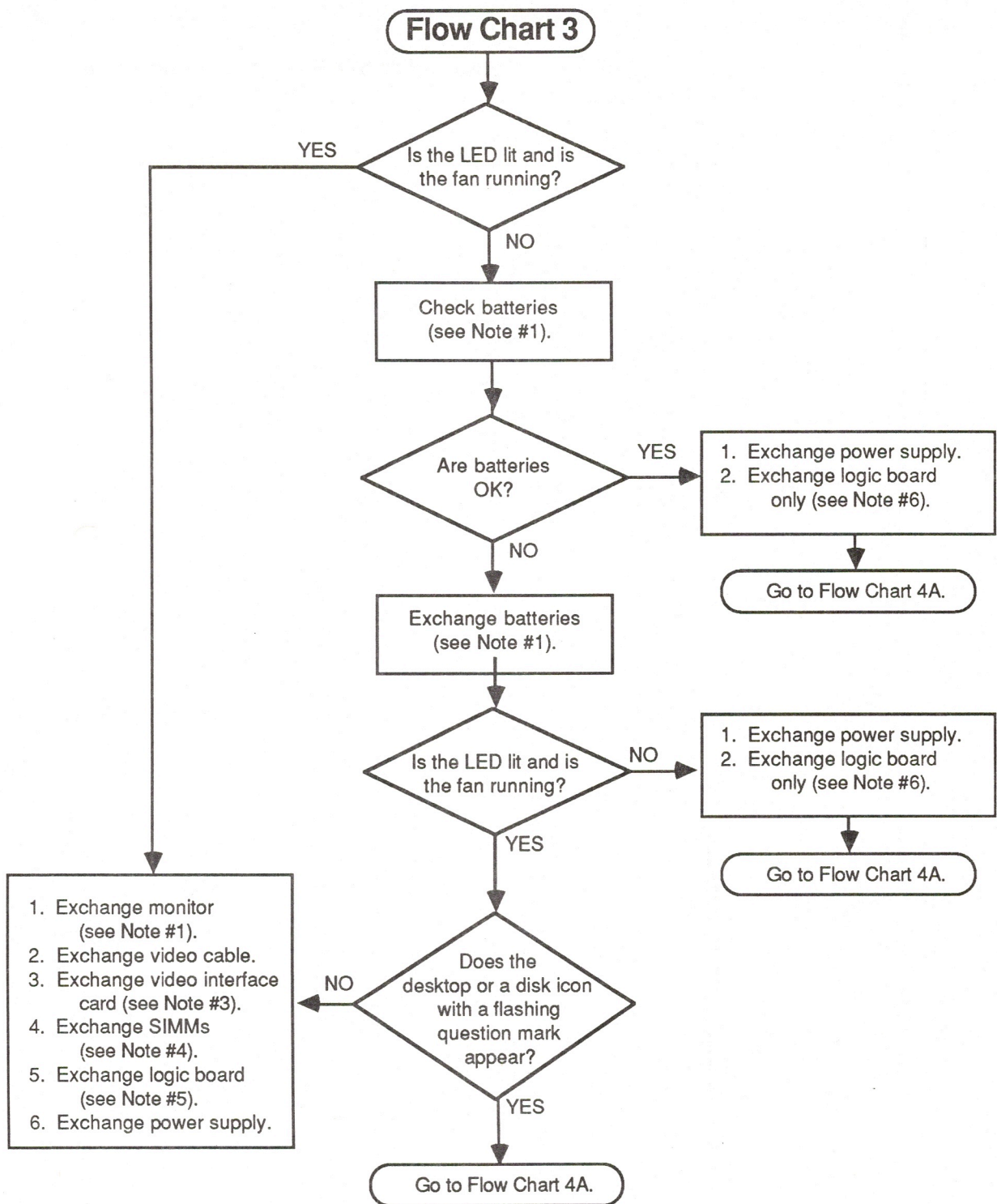
Flow Chart 2

1. Refer to Section 3, Diagnostics, for complete information.
2. Refer to *SCSI Hard Disk Drives Technical Procedures* for complete instructions.
3. Install the **customer's SIMMs** on the **replacement logic board**.



Flow Chart 3

1. Refer to "Battery Verification" for complete instructions on checking the lithium batteries.
2. If exchanging the monitor will correct the problem, refer to the *Apple High-Res Monochrome Monitor Technical Procedures* or *Apple High-Res RGB Monitor Technical Procedures* to isolate the monitor problem to the module level.
3. If exchanging the video interface card corrects the problem, and if the customer's card has the video expansion kit installed, refer to Section 5, Additional Procedures, for information on troubleshooting the eight replaceable RAMs.
4. There are two steps to perform when exchanging the SIMM modules. Refer to "SIMM Verification" for complete instructions on verifying and troubleshooting the SIMMs.
5. If the known-good SIMMs did not correct the problem, install the **customer's SIMMs** on the **replacement logic board**.
6. Exchange only the logic board by installing the **customer's SIMMs** on the **replacement logic board**.



Flowchart 4

1. Refer to Section 3, Diagnostics, for complete information.
2. Install the **customer's SIMMs** on the **replacement logic board**.

Flow Chart 4A

Insert MacTest II diskette. Power on.

Does the test screen appear?

NO

1. Exchange drive 1 cable.
2. Exchange disk drive 1.
3. Exchange power supply.
4. Exchange logic board only (see Note #2).

YES

Run MacTest II diskette (see Note #1).

Power off. Reconnect the 2nd drive (if installed). Power on.

Flow Chart 4B

Does the desktop or a disk icon with a flashing question mark appear?

NO

1. Exchange drive 2 cable.
2. Exchange disk drive 2.
3. Exchange power supply.
4. Exchange logic board only (see Note #2).

YES

Insert MacTest II diskette. Power on.

Does the test screen appear?

NO

1. Exchange drive 2 cable.
2. Exchange disk drive 2.
3. Exchange power supply.
4. Exchange logic board only (see Note #2).

YES

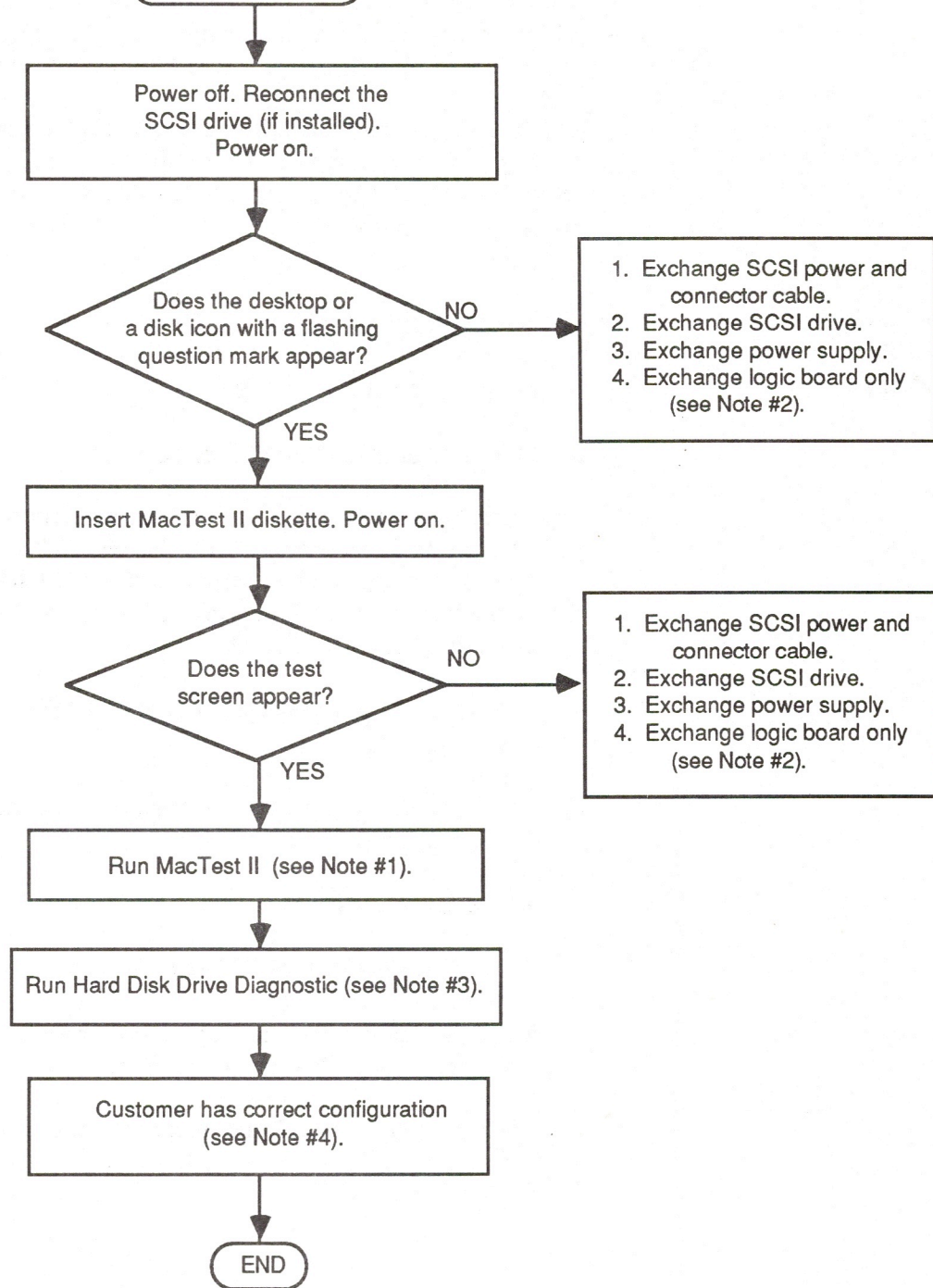
Run MacTest II (see Note #1).

Go to Flow Chart 5.

Flow Chart 5

1. Refer to Section 3, Diagnostics, for complete information.
2. Refer to *SCSI Hard Disk Drives Technical Procedures* for complete instructions.
3. Install the **customer's SIMMs** on the **replacement logic board**.
4. The customer must always get back the same system configuration he brings in. Refer to "Module Exchange Information."

Flow Chart 5



□ SIMM VERIFICATION

Introduction

The service exchange logic board comes with four 256K SIMMs. Mark each known-good SIMM with a dot of white correction fluid or a small sticker. Whatever you use, be sure it will not come off while you are testing.

The SIMMs that are installed on the customer's logic board may be defective. To verify this you will be removing all of the customer's SIMMs and installing the known-good SIMMs.

Isolating to the Customer's SIMMs

1. Remove the top cover.
2. Remove the drive mount.
3. Remove the customer's SIMMs.

Note: Using the configuration chart, record the number and the sizes of the SIMMs. The customer should get the same number and sizes back! Refer to Section 5, Additional Procedures, for information on identifying the SIMMs.

4. Install the four known-good 256K SIMMs in Bank A (Figure 1, #1).
5. Place the drive mount into position, and connect drive one only.
6. Power on the system.
7. Insert the *MacTest II* diskette.

If the test boots, run it. Then continue with the appropriate verification procedure.

If the test does not boot, return to the appropriate flow chart.

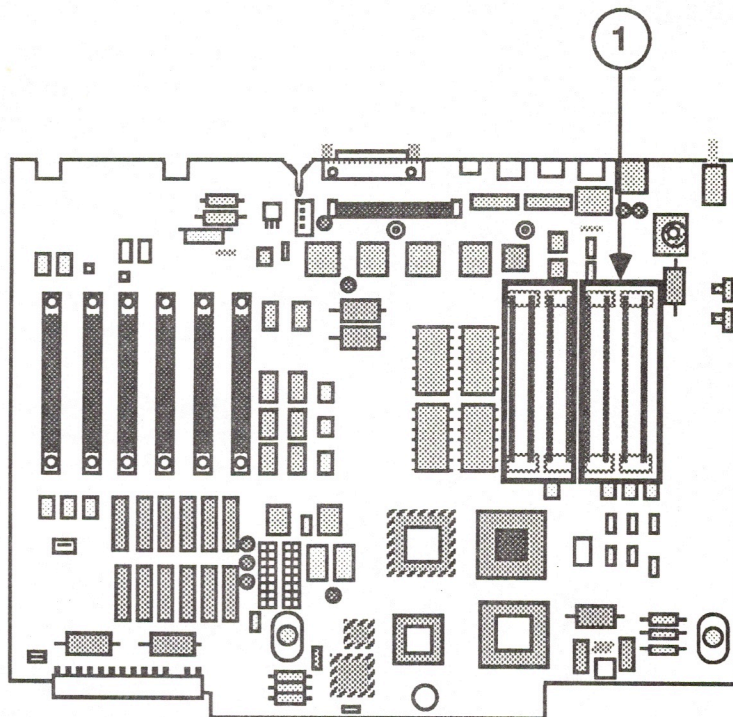


FIGURE 1

Verification

If the customer has 256K SIMMs or 1M SIMMs installed, you will need to verify all of them. Use the flow chart and referenced notes on the next two pages to perform the verification of the SIMMs.

Materials Required

If verifying 256K SIMMs, you will need four 256K known-good SIMMs.

If verifying 1M SIMMs, you will need four 1M known-good SIMMs

**Verification
Flow Chart
Notes**

1. Locate Bank A on the logic board and install three known-good SIMMs (Figure 2, #1).
2. During a normal startup sequence, a medium-pitched soft chord is emitted; then a disk icon with a flashing question mark is displayed on the screen. If either of these things does not happen, refer to "Startup and Error Chords" for additional information.
3. Be sure to set the defective SIMM where it will not be mixed up with the others.
4. Return to the beginning of the flow chart and perform the same procedure for Bank B (Figure 2, #2).

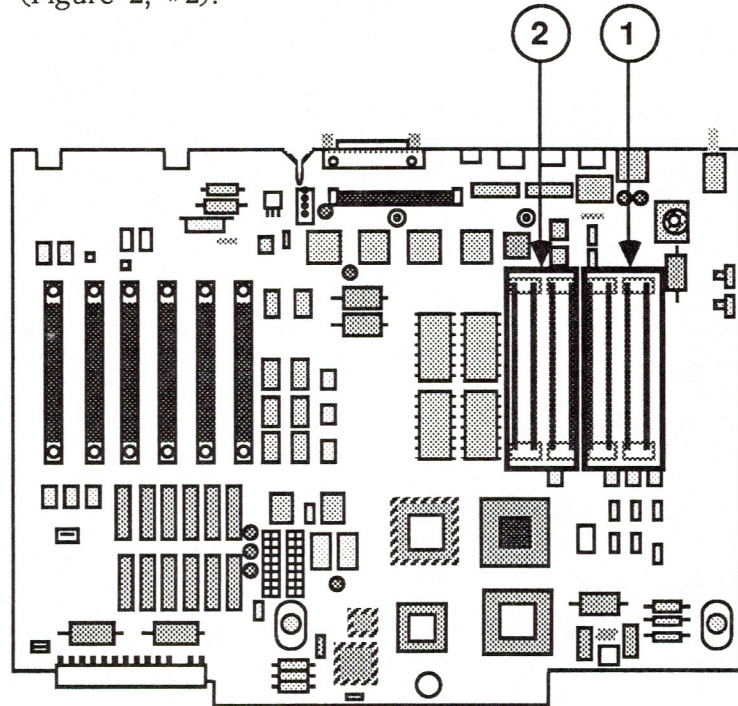
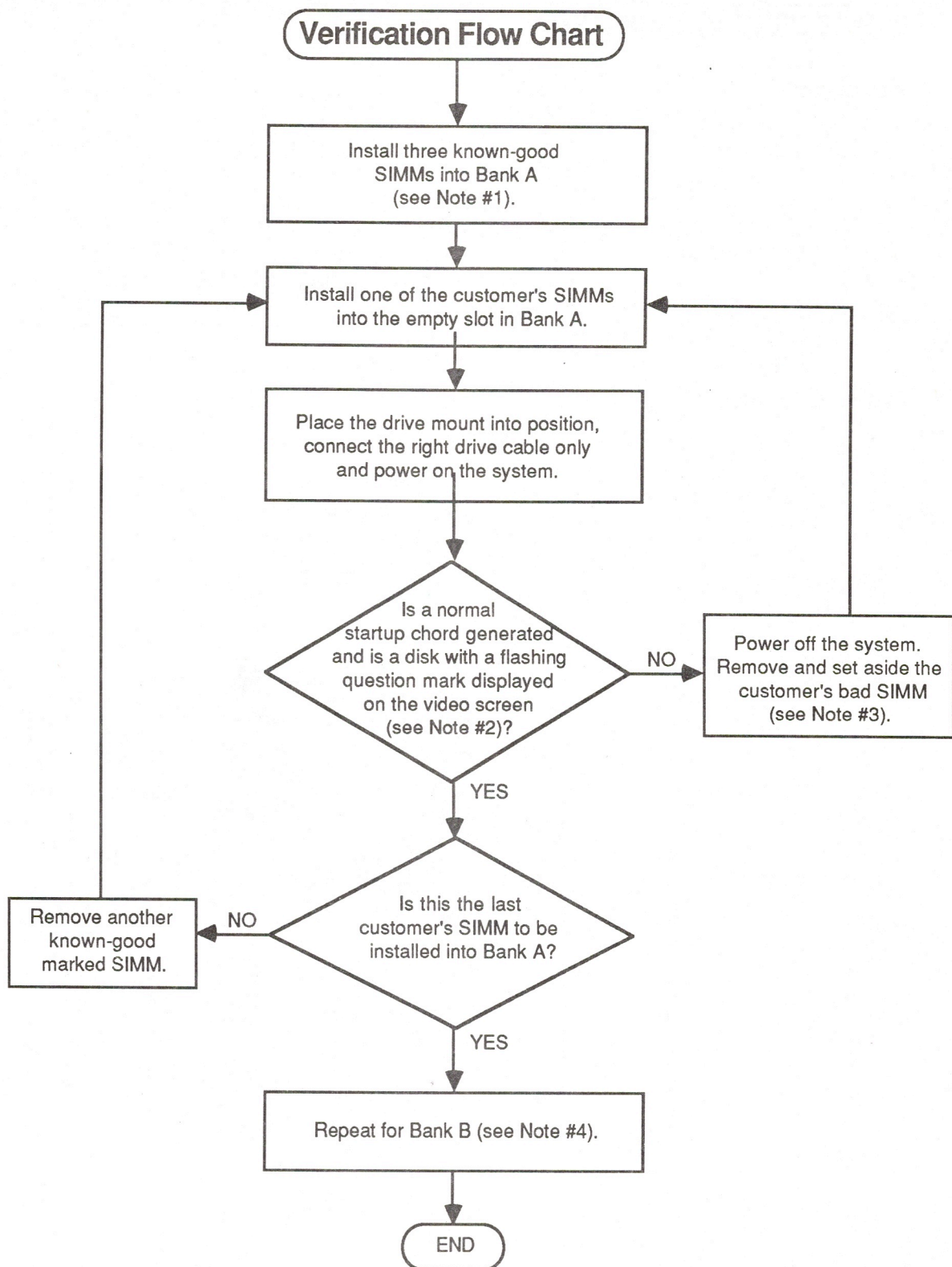


FIGURE 2



❑ BATTERY VERIFICATION

Introduction

There are two lithium batteries on the Macintosh II logic board. These batteries are part of the power-on circuit. If either battery falls below specifications, **both** must be removed and replaced.

WARNING: *Lithium batteries, the type used in the Macintosh II, have some potential for explosion if improperly handled. Follow the procedure below exactly as written.*

Materials Required

Voltmeter

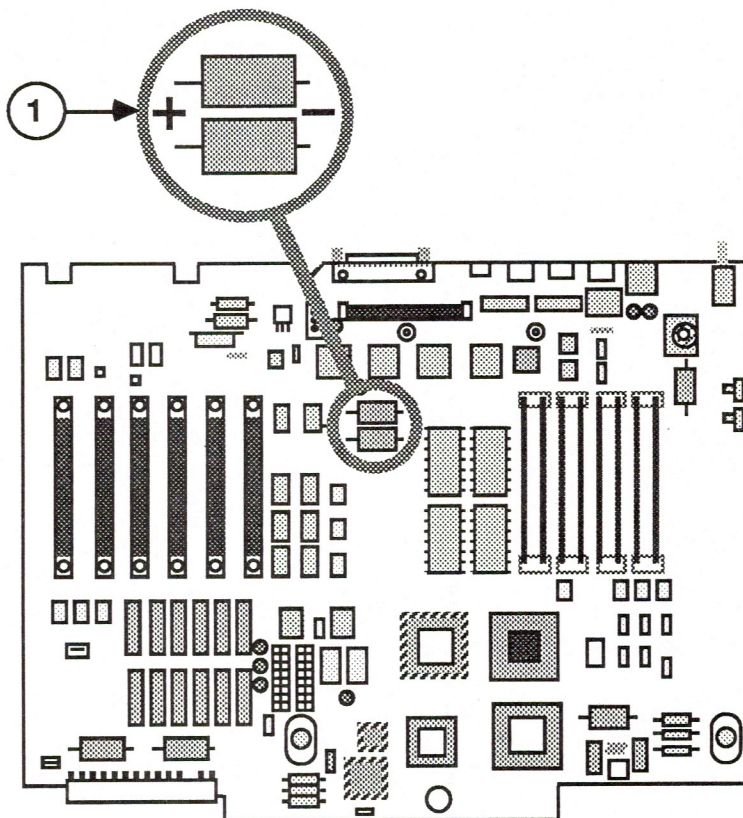


FIGURE 3

Verification Procedure

To check the lithium batteries with a voltmeter:

1. Be sure power is off. Then remove the top cover of the Macintosh II.
2. Set the voltmeter range to measure 10 volts DC.
3. Touch and hold the **positive probe** of the voltmeter to the **positive side** of one of the batteries (Figure 3, #1).
4. Touch and hold the **ground probe** of the voltmeter to the **negative side** of the same battery.
5. The reading for a good battery should be **above 2.8 volts**.
6. Return to step 1 and repeat for the other battery.

If either battery falls below 2.8 volts, replace both batteries. Refer to Section 5, Additional Procedures, for replacement instructions.

❑ CUSTOMER'S CONFIGURATION CHART

The chart below can be copied and used to keep track of a customer's system configuration. Once it has been filled out, attach it to the system. This will help you make absolutely sure that the customer gets back the same configuration that he brought in.

Macintosh II Configuration			
Customer			
Serial Number			
Internal Disk Drives	1	2	
Internal Hard Disk SC	20M	40M	80M
Memory Management Unit	HMMU PMMU		
SIMMs			
Bank B	# Installed	Bank A	# Installed
256K		256K	
1M		1M	

Macintosh II

Section 5 – Additional Procedures

□ CONTENTS

5.2	Logic Board RAM Identification and Upgrades
5.2	Introduction
5.2	Identification
5.4	Upgrades
5.6	Video Card RAM Upgrade
5.6	Introduction
5.6	Materials Required
5.6	Installation
5.6	Troubleshooting the Video RAM Upgrade
5.6	Materials Required
5.6	Procedure
5.7	Battery Replacement
5.7	Storage and Handling
5.7	Disposal
5.8	Procedure
5.9	Materials Required

Note: To perform the 800K disk drive or hard disk SCSI upgrades refer to Section 2, Take-Apart.

Note: If a step is underlined, instructions for that step can be found in Section 2, Take-Apart.

□ LOGIC BOARD RAM IDENTIFICATION AND UPGRADES

Introduction

The RAM is provided in packages known as Single In-Line Memory Modules (SIMMs). Each SIMM contains eight surface-mounted dynamic RAM (DRAM) chips on a small, narrow, printed circuit board. Each SIMM board has contacts on one edge that fit into sockets on the motherboard.

The amount of RAM can be changed simply by installing SIMMs of differing sizes in various configurations, which will be explained later.

Identification

The SIMMs are available with two sizes of RAM, 256K and 1M.

256K SIMMs

The 256K SIMMs have 8 ICs (Figure 1). Each IC has 5 pins (or legs) on each side (Figure 1, #1).

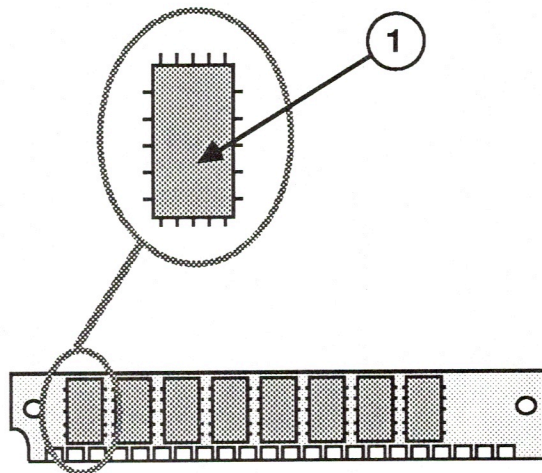


FIGURE 1

IMPORTANT: You must use 120ns 256K SIMMs on the Macintosh II. The 150ns SIMMs will cause serious timing problems.

There are two speeds of 256K SIMMs—120ns and 150ns—that are usable in the Macintosh SE. **Only the 120ns SIMMs are suitable for the Macintosh II.** You can identify a 120ns SIMM by the number 12 that is printed on the back.

1 M SIMMs

Like the 256K SIMMs, the 1M SIMMs also have 8 ICs (Figure 2, #1). But each 1M IC has 10 pins (or legs), and they are located on only two sides of the chip (Figure 2, #1). The 1M IC is also approximately 25% larger than the 256K IC.

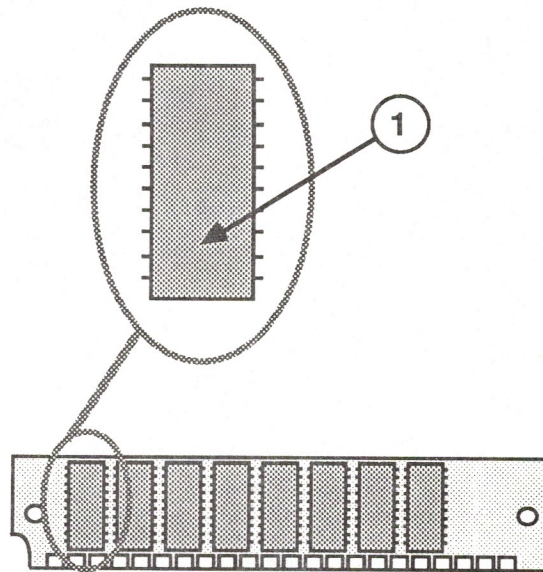


FIGURE 2

Upgrades

Various RAM upgrades are possible on the logic board, depending on the number of SIMMs you use and the size of the chips that you mount on the SIMMs.

For installation purposes, the SIMMs are labeled Bank A (Figure 3, #1) and Bank B (Figure 3, #2).

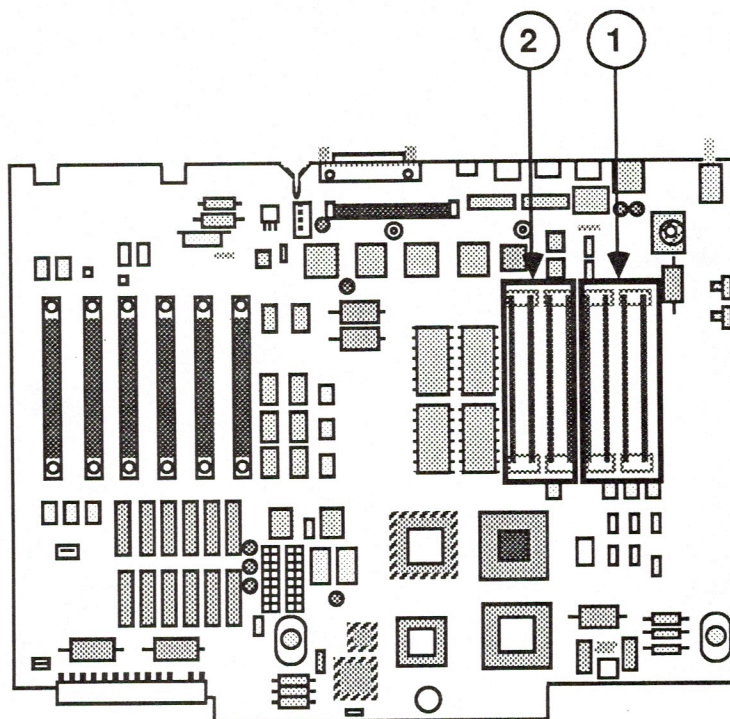


FIGURE 3

Within each bank are four slots which are grouped by twos. The slots within Bank A are labeled 1 (Figure 4, #1) and 2 (Figure 4, #2). The slots within Bank B are labeled 3 (Figure 4, #3) and 4 (Figure 4, #4).

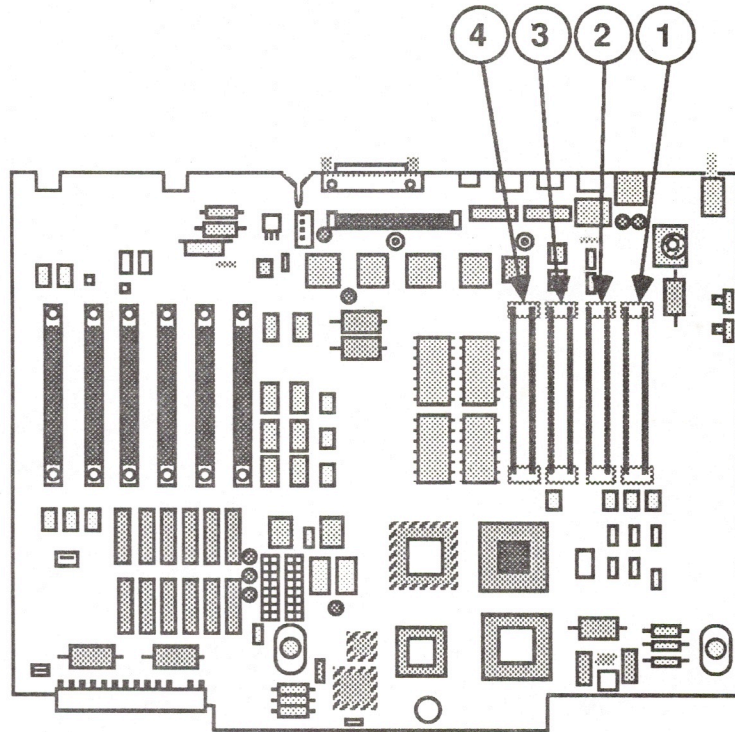


FIGURE 4

The following chart summarizes the various configurations the Mac II will support.

<u>RAM</u>	<u>Bank A (Figure 3 #1)</u>	<u>Bank B (Figure 3 #2)</u>
1M	Four 256K SIMMs	Empty
2M	Four 256K SIMMs	Four 256K SIMMs
4M	Four 1M SIMMs	Empty
5M	Four 1M SIMMs	Four 256K SIMMs
8M	Four 1M SIMMs	Four 1M SIMMs

CAUTION: Other configurations, such as a single SIMM or a pair of differently sized SIMMs, will not function correctly.

□ VIDEO CARD RAM UPGRADE

Introduction

The Macintosh II Video Card is used with both the AppleColor High-Resolution RGB Monitor and the Apple High-Resolution Monochrome Monitor. The card, as it is shipped, supports 2, 4, or 16 simultaneous colors or shades of gray. By installing the Video Card Expansion Kit (8 RAMs), the same card can display up to 256 simultaneous colors or shades of gray.

Materials Required

Grounded workbench and wriststrap
Video Card Expansion Kit (8 RAMs)

Installation

1. Install the eight new RAMs in the appropriate locations: B1, C1, D1, E1, G1, H1, G2, and H2 (Figure 5, #1).

Note: The notch at the end of each RAM should face the DB-15 connector on the rear of the card.

2. Reinstall the video interface card into the Macintosh II, and connect the monitor.
3. Insert the *MacTest II* diskette and power on the system. Open the **Control Panel**. Then select the monitor control and set the shade selection to 256. Then run the diagnostic to verify that the video RAM upgrade is functioning.

Troubleshooting the Video RAM Upgrade

A bad RAM IC on the video interface card could cause various video problems. There are eight replaceable RAMs on the card.

Materials Required

Grounded workbench and wriststrap
Eight known-good, marked, video RAMs

Procedure

1. Disconnect the monitor and remove the video card from the Macintosh II.

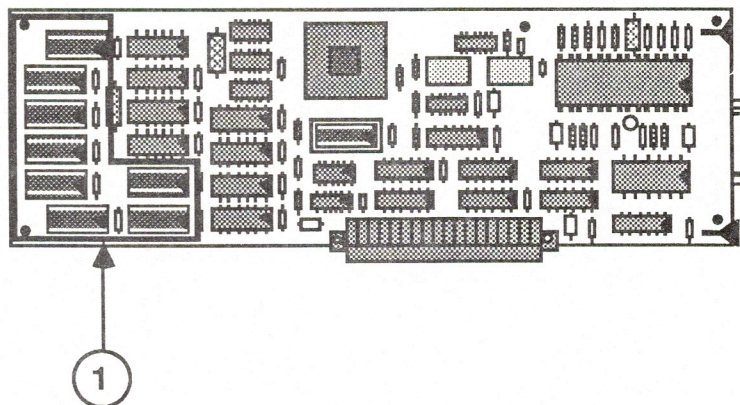


FIGURE 5

2. Remove one RAM at a time and replace it with a known-good RAM. The locations are B1, C1, D1, E1, G1, H1, G2, and H2 (Figure 5, #1).

Note: The notch at the end of each RAM should face the DB-15 connector on the rear of the card.

3. Install the video interface card into the Macintosh II, and connect the monitor.
4. Insert the *MacTest II* diskette and power on the system. Open the **Control Panel**. Then select the monitor control and set the shade selection to 256. Then run the diagnostic to verify that the video RAM upgrade is functioning.
5. Repeat from step 1 until the card functions correctly or until all the upgrade RAM has been replaced.

If the problem still exists, exchange the video interface card, install the customer's RAM and retest the card.

□ BATTERY REPLACEMENT

WARNING: *Lithium batteries, the type used in the Macintosh II, have some potential for explosion if improperly handled.*

Storage and Handling

Take the following precautions when storing and handling lithium batteries.

- When Apple's lithium batteries are shipped to you, they are sealed in individual zip-lock wrappers. When you receive them, check to make sure the wrappers are intact. If they are not, mend the wrapper before you store the batteries.
- Store the batteries in the packaging in which you receive them.
- The storage area for lithium batteries should be well marked, and access to the area should be restricted.

Disposal

Lithium batteries cannot be recharged and will require disposal when "dead." But you cannot throw them away as you would other batteries because lithium is water-reactive, in addition to being potentially explosive.

Lithium batteries must be disposed of as a hazardous waste.

WARNING: *"Dead" lithium batteries are considered hazardous waste and must be returned to Apple in their original packaging for disposal following EPA guidelines.*

Because of this hazard, Apple recommends the following course of action:

After removing a "dead" battery from a board, clip off the lead wires and place the battery in the zip-lock wrapper and original packaging from which the replacement battery was taken. Mark the battery DEAD and return it to Apple, where it will be disposed of following EPA guidelines.

Procedure

The two long-life lithium batteries in the Macintosh II should serve for the life of the product. Refer to Section 4, Troubleshooting, to check the condition of the batteries. But if the batteries should fail for some reason, replace both of them according to the following procedure.

Materials Required

Soldering iron (60 watt, 700 degrees)
Desoldering tool
60/40 resin-core solder
Small wire cutters
Grounded workbench and wriststrap

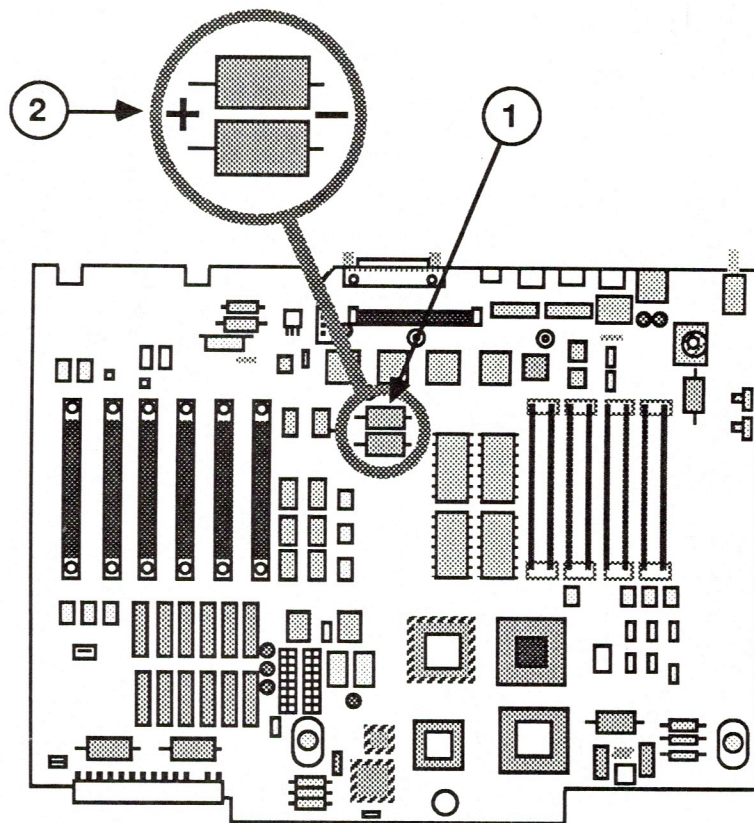


FIGURE 6

Remove

1. Remove the Macintosh II logic board from the case.
2. Locate the two batteries on the front of the logic board (see Figure 6, #1).
3. Cut the lead wires that hold one of the batteries. Then follow the disposal procedures described on the previous page.
4. Turn the logic board over. Locate the two soldered leads that held the battery in place. Apply fresh solder to the two connections.
5. Desolder the two connections, and remove the small stub of wire in both holes.
6. Repeat steps 3 through 5 for the second battery.

WARNING: *Do not force the connections free or you may remove the traces from the board. Repeat step 5 if necessary.*

Replace

1. Insert the new battery so its the positive lead is inserted into the positive-marked hole on the logic board, and so the battery is flush with the board.

CAUTION: *Be sure the positive side of the battery is in the correct location (see Figure 6, #2). Failure to do so can result in damage to the logic board.*

2. Solder the battery lead wires into place. Then clip the extra length of wire from the back of the board. (A length of about 1/16 inch is sufficient.)
3. Repeat steps 1 and 2 for the second battery.
4. Replace the logic board into the Macintosh II system.
5. Set the clock using the Control Panel.

Macintosh II

Illustrated Parts List

❑ CONTENTS

- IPL.3 System (Figure 1)
- IPL.5 Logic Board (Figure 2)
- IPL.7 Video Board (Figure 3)
- IPL.9 Keyboard (Figure 4)
- IPL.11 Extended Keyboard (Figure 5)
- IPL.13 Mouse (Figure 6)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Macintosh II, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

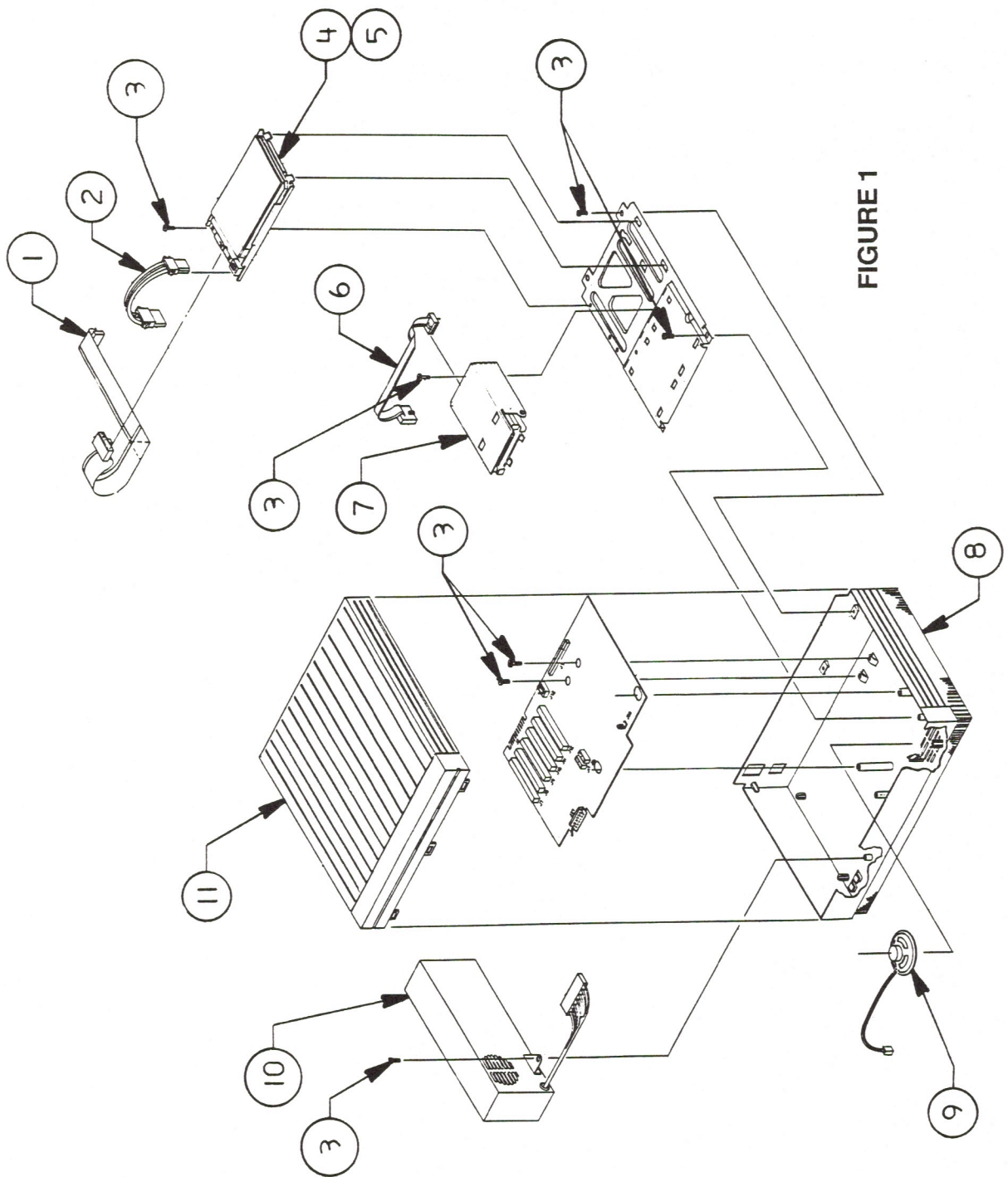


FIGURE 1

□ MACINTOSH II – SYSTEM (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	590-0566	Cable, Macintosh II Internal Hard Disk
2	590-0364	Cable, Internal Hard Disk Power
3	462-4100	Screws
4	661-0391	HDA, 5.25, 40M, SCSI
5	661-0373	HDA, 3.5, 20M, SCSI
6	590-0188	Cable, 3.5 Internal Drive (yellow stripe)
7	661-0345	800K Mechanism, Apple 3.5 Drive
8	630-5227	Bottom Cover Assembly
9	630-5222	Speaker
10	661-0374	Macintosh II Logic Board
11	661-0375	Macintosh II Power Supply
12	630-5229	Top Cover and Latch Assembly

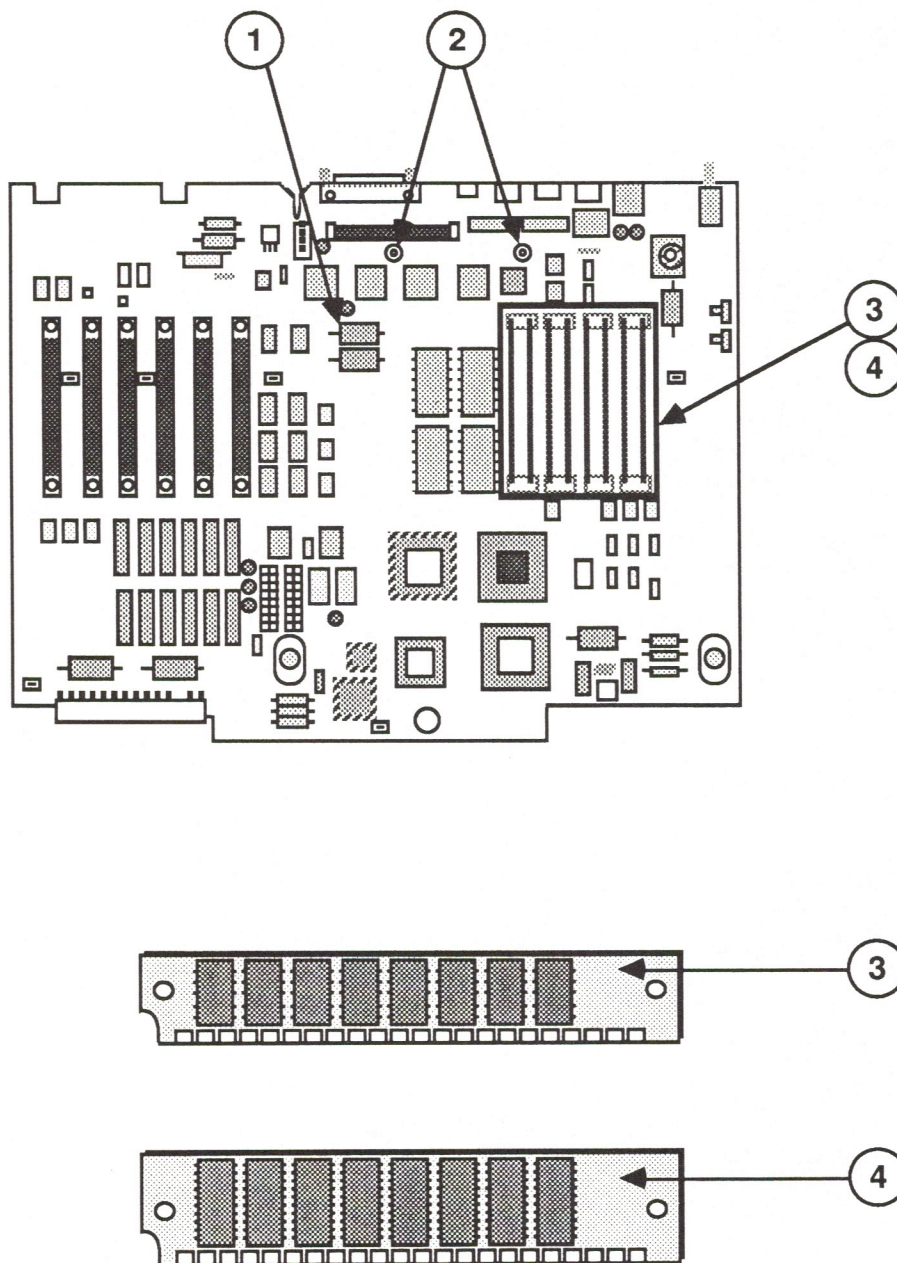


FIGURE 2

□ MACINTOSH II – LOGIC BOARD (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	742-0009	Battery
2	462-4100	Screws
3	661-0402	SIMM, 256K, 120 ns
4	661-0403	SIMM, 1M, 120 ns

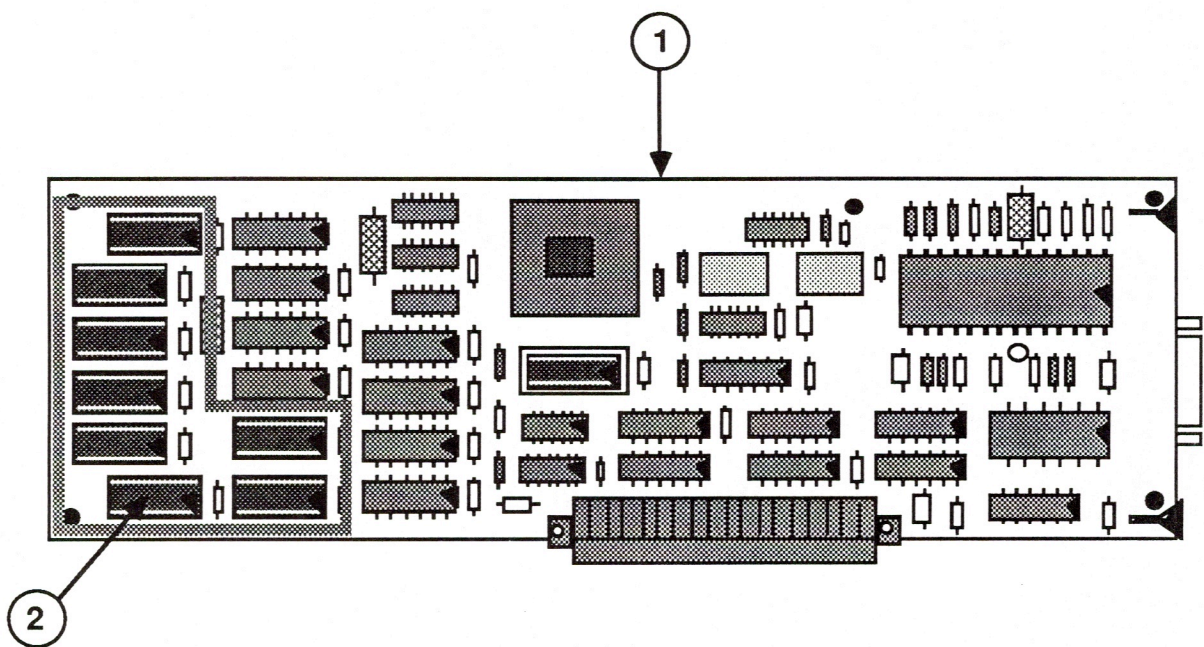


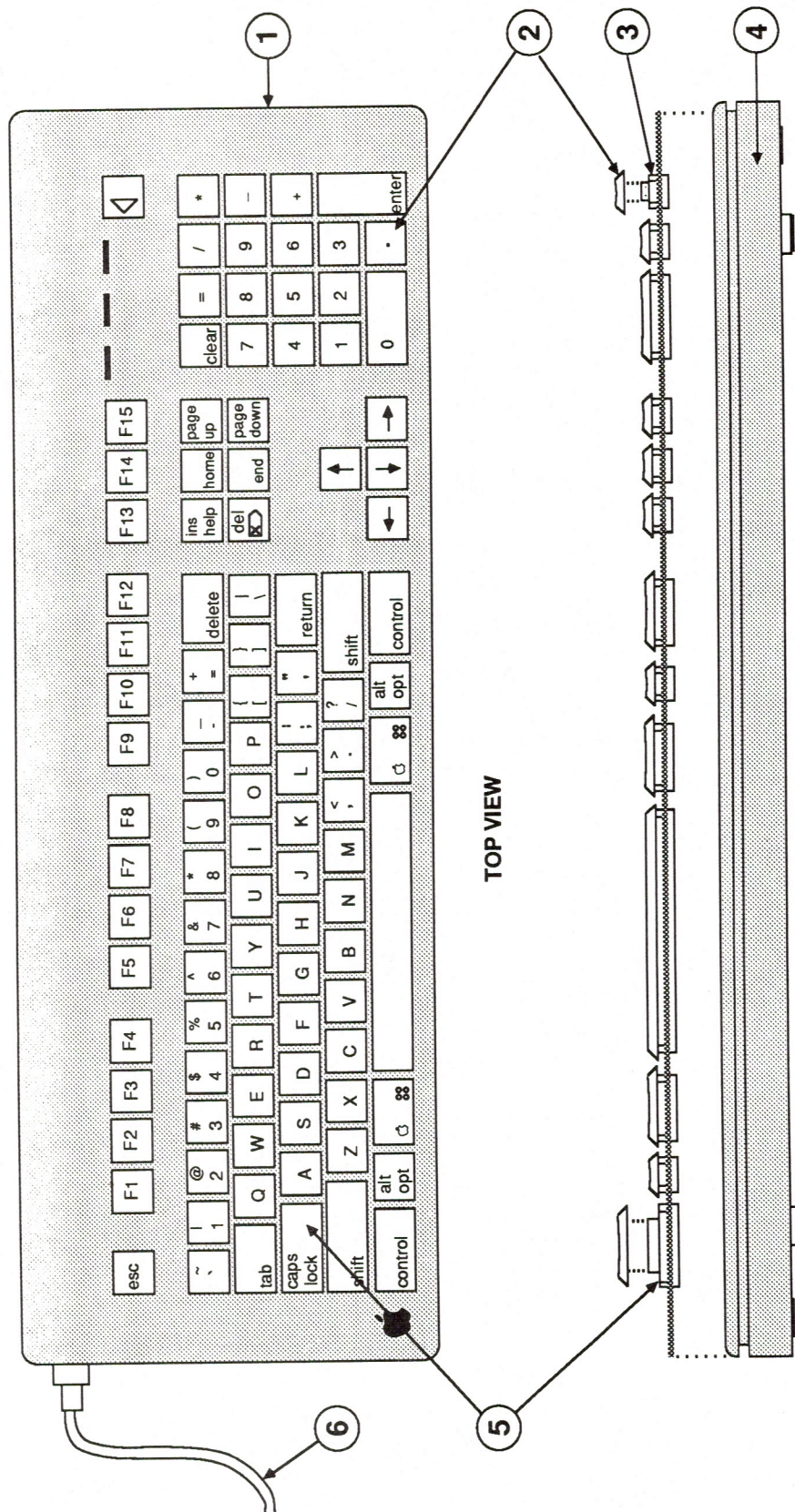
FIGURE 3

□ **MACINTOSH II – VIDEO BOARD (Figure 3)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0376	Macintosh II Video Card
2	334-0024	Video RAM IC, 150 ns

□ MACINTOSH II – KEYBOARD (Figure 4)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0383	Apple Keyboard
1	815-1016	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1017	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard



TOP VIEW

FRONT VIEW

FIGURE 5

□ MACINTOSH II – EXTENDED KEYBOARD (Figure 5)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0384	Apple Extended Keyboard
1	815-1018	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1019	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard

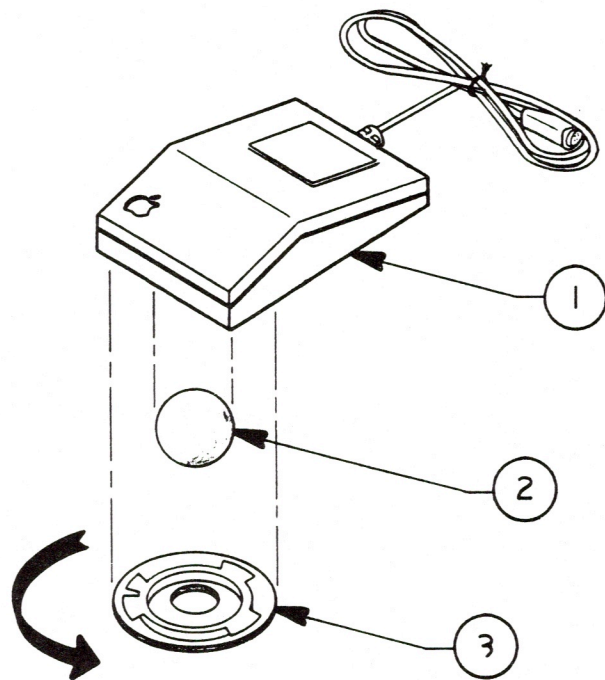


FIGURE 6

□ MACINTOSH II – MOUSE (Figure 6)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0338	Apple Desktop Bus Mouse
1	699-8001	Rubber Coated Mouse Ball
2	076-0231	ADB Mouse Ball Retainer

**End of Macintosh II
Section Start of
Macintosh External
Disk Drive Section**

MACINTOSH EXTERNAL DISK DRIVES TECHNICAL PROCEDURES

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Macintosh External Disk Drives Technical Procedures

Section 0

Service Notes

Contents:

Troubleshooting Macintosh External Disk Drive (400K).....	0.3
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TROUBLESHOOTING MACINTOSH EXTERNAL DISK DRIVE (400K)

If a suspect drive fails MacTest or fails to read and/or write to a disk it will be necessary to check the stepper motor located inside the disk drive. There are two types of stepper motors used in the Macintosh 400K drive, one of which is not compatible with rev. A ROMs. Perform the following procedure to eliminate ROM/stepper motor incompatibility as a possible cause of the drive problem.

1. Remove the drive's case as described in **Section 1, Take-Apart.**
2. Look for the label on the drive's stepper motor housing. If you find a circular label at the flat end facing the rear of the drive, the stepper motor is compatible with any revision of the Macintosh boot ROM and the drive should be replaced if it fails MacTest.
3. If you find a square label on the curved side of the stepper motor housing it will be necessary to check the customer's Macintosh to see which ROM revision he has. If the Macintosh has rev. A ROMs, upgrade them to the latest revision and retry MacTest on the drive.
4. If the disk drive still fails MacTest or fails to read and/or write to the disk, replace the disk drive.

EXCHANGING MACINTOSH 800K DRIVE MECHANISMS

Refer to **Drive Compatibility** under the **Disk Drives** tab to find out which of the Apple 3.5-inch 800K drive mechanisms may be used in the Macintosh External 800K Drive.

The drive mechanism **MUST BE REMOVED** from the housing and shipped in the Apple-approved shipping fixture (refer to **Section 3, Illustrated Parts List**). The packing diskette **MUST ALSO BE INSTALLED** to prevent damage during shipping.

800K DISK DRIVE - DISKETTE EJECTION PROBLEMS

Whenever a diskette from an internal or external 800K disk drive does not fully eject, the user must push the diskette back in and attempt to eject it electronically. This can be done by holding down the **<SHIFT>** and **<COMMAND>** (cloverleaf) keys and pressing **1** (for the internal drive) or **2** (for the external drive). The **Eject** command from the **File** menu can also be used. The user should attempt this two or three times. As a last resort, the user can insert a large paper clip in the pin hole located beneath and to the right of the slot where the diskette is inserted.

IMPORTANT: Once the diskette becomes "frozen" and does not fully eject, the user must NOT force the diskette by pulling it out from the drive. Doing so can cause possible damage to the disk drive mechanism. If the user has tried to forcibly remove the diskette from the disk drive, refer to "Removing Diskettes Which Will Not Eject" below.

In addition to the precautions discussed above, the user should be aware of other factors which can affect the insertion and ejection of a diskette.

- A diskette should be inserted by pressing the diskette gently into the drive. Avoid grasping and pushing the diskette, as this may cause the diskette to go in only part way and stop. If this happens the user should attempt to eject the diskette as described above.
- Diskettes which contain three or more labels may not slide easily into and out of the diskette slot in the Macintosh case. Should a third label be required, either the other labels should be removed first or the diskette should be discarded.

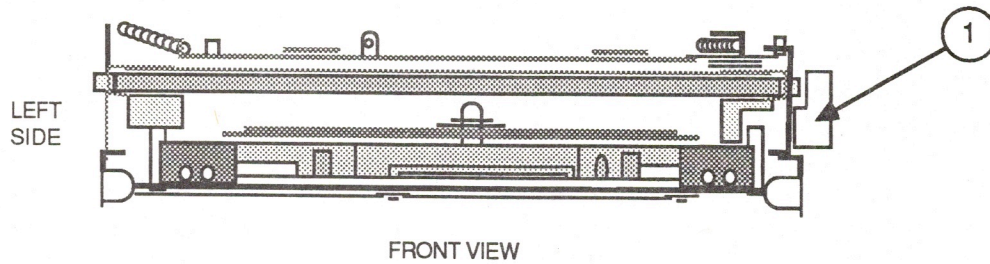


FIGURE 1

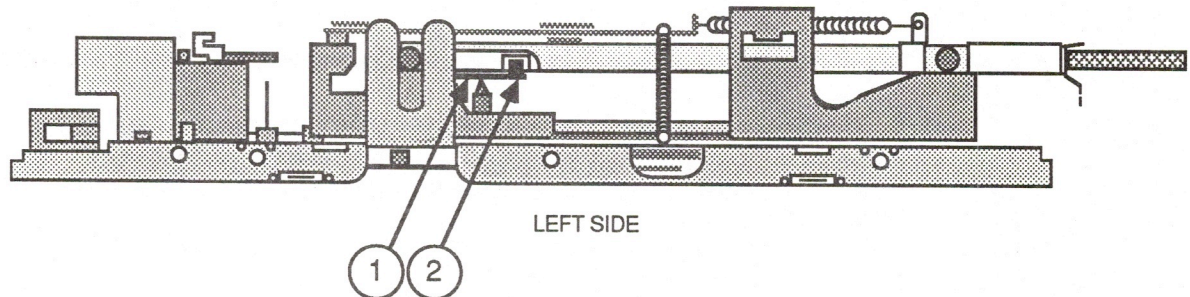


FIGURE 2

Removing Diskettes Which Will Not Eject

If a diskette becomes "jammed" in a customer's disk drive, the following procedure should be used to remove it prior to returning the disk drive.

1. Remove the disk drive assembly. (See **Section 2, Take-Apart.**)
2. Place the disk drive mechanism on a flat surface, with the Printed Circuit Board facing down and the diskette opening facing you (see Figure 1).
3. If the diskette is not already fully inserted into the disk drive, push it in until it is properly seated.
4. Press the eject lever at the right side of the disk drive (see Figure 1, #1).
5. Turn the disk drive so that the left side is facing you.
6. Locate the small arm with a cylindrical cog at its end. This arm is located near the left-to-right center of the drive mechanism (see Figure 2, #1). This cog will be caught in the half-moon depression of the diskette case.
7. Insert a small screwdriver at the position shown in Figure 2, #2 and **gently** move the arm away from the diskette until the diskette pops forward slightly. Remove the diskette from the disk drive.
8. Return the defective disk drive to Apple and follow the instructions in **Section 2, Take-Apart**, to replace the disk drive with a new unit.

Macintosh External Disk Drives
Technical Procedures

Section 1

Macintosh External Disk Drive (400K) Take-Apart

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Remove and Replace the External Drive.....1.3

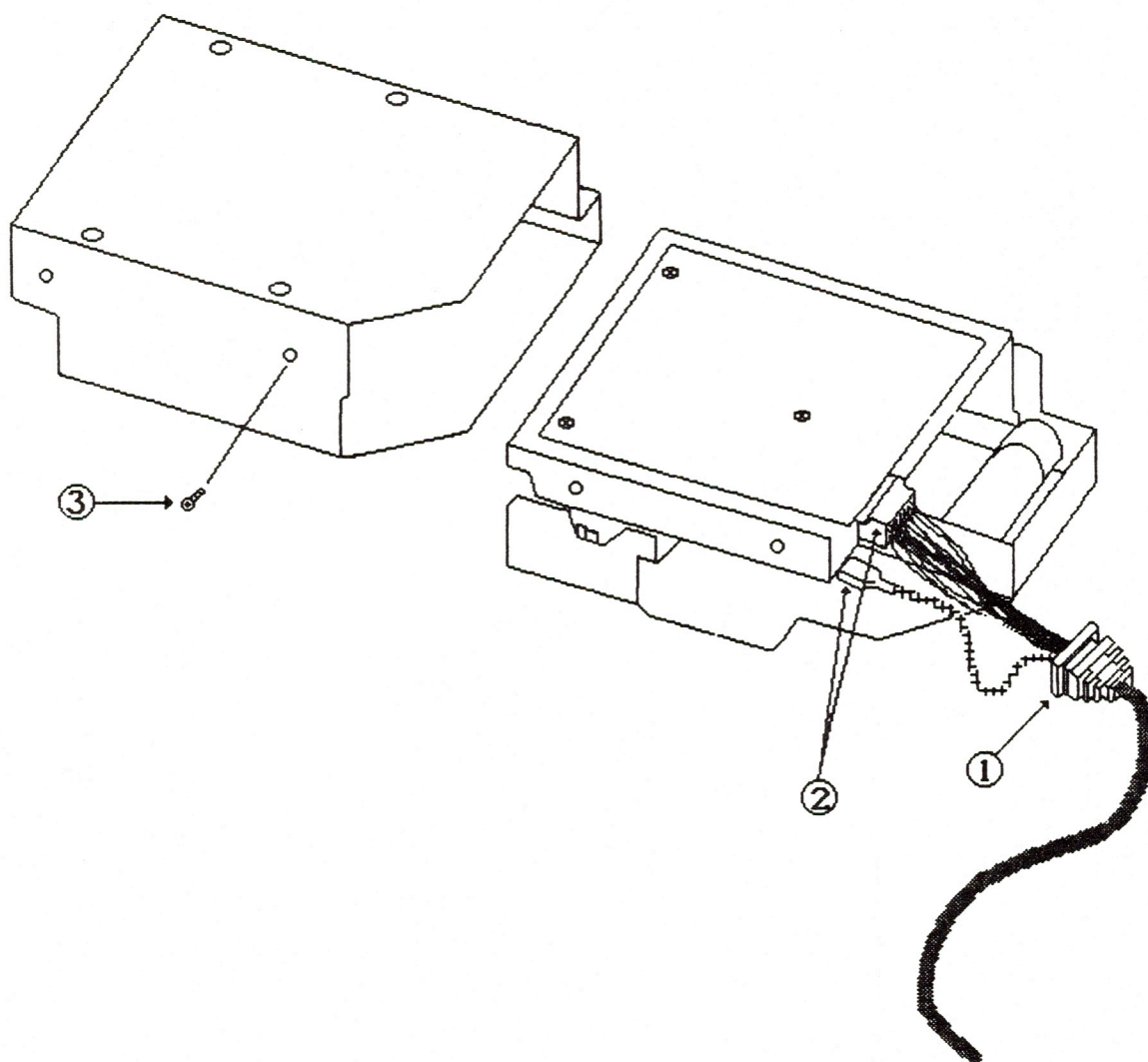


FIGURE 1

REMOVE AND REPLACE THE EXTERNAL DISK DRIVE

Equipment Required:

#1 Phillips screwdriver

1. Turn the disk drive over with the bottom facing up.
2. Remove the six screws and washers from the bottom cover.
NOTE: The two black screws do not have washers.
3. Lift up the back of the bottom cover about an inch and pull it out from the front bezel.
4. Lift up the cable grommet (see Figure 1, #1) from the case and support it with one hand; with the other hand lift up the back of the metal drive housing and remove the drive from the bottom cover.
5. Carefully remove the cable connector. Remove the screw that holds the grounding tab to the disk drive (see Figure 1, #2). **Do not remove the grounding strap from the grounding tab.**

NOTE: The grounding tab is not included on exchange drive mechanisms.
6. Remove the screw on the outside of the metal drive housing (see Figure 1, #3).
7. Slide the drive out of the metal housing.

Replace:

1. Connect the drive cable. Position the grounding tab and replace the screw on the new drive (see Figure 1, #2).
2. Place the new drive into the metal housing and replace the screw (see Figure 1, #3).
3. Place the drive into the bottom cover at an angle and support the cable assembly while you push the drive forward.
4. Replace the cable grommet in its slot.
5. Replace the top cover and screws.

WARNING: Make sure the Macintosh is powered off before connecting the disk drive to the built-in port. Failure to do so can result in damage to the Disk Drive and/or the Macintosh Logic Board.

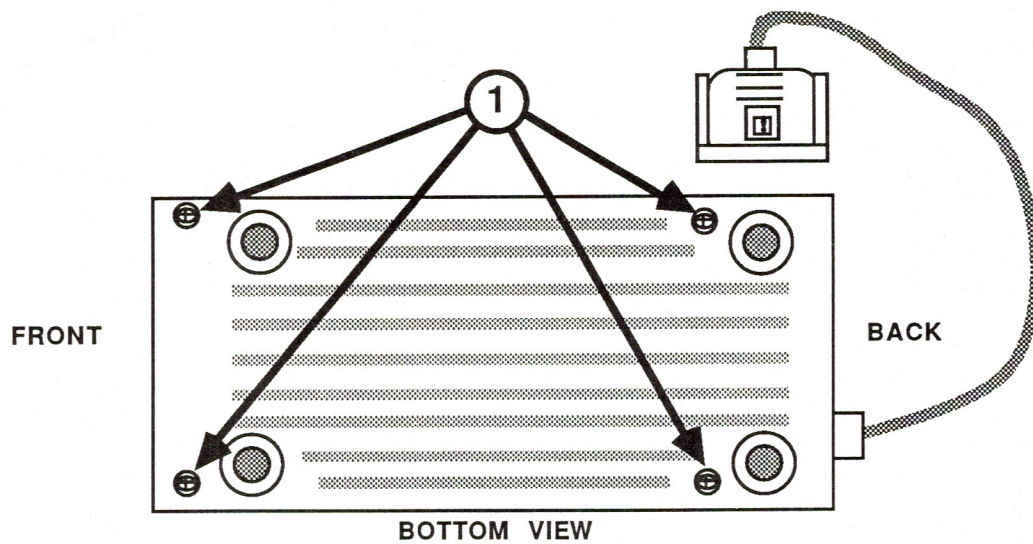
Macintosh External Disk Drives Technical Procedures

Section 2

Macintosh 800K External Disk Drive Take-Apart

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BOTTOM VIEW

FIGURE 1

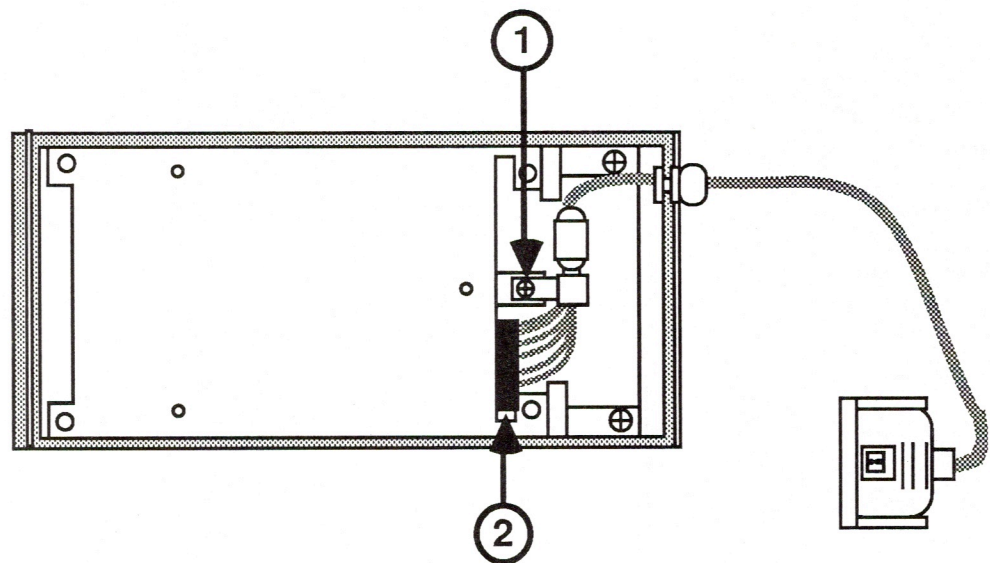


FIGURE 2

THINGS TO REMEMBER

1. The Macintosh Logic board should have new ROMs installed to support the 800K external drive. If the ROMs are not installed, the Macintosh will not recognize the external drive. (Refer to **Macintosh Technical Procedures, Section 4, Additional Procedures** for more information.)
2. You may use 400K media in the 800K drive, but if you do the 800K drive may emit a high squealing sound. This does not indicate a problem. The 400K media is coarse and the 800K drive has very tight specifications. This will not cause damage to either the drive or the media.
3. When transporting or shipping the 800K drive, be sure to have the packing diskette installed in the disk drive.

TOOLS REQUIRED

Phillips screwdriver - medium

REMOVE AND REPLACE THE BOTTOM COVER AND INTERFACE CABLE

Remove

1. Remove the four screws (see Figure 1, #1).
2. Lift the bottom cover off.
3. Remove the screw from the clamp holding the interface cable in place (see Figure 2, #1).
4. Disconnect the interface cable from the drive (see Figure 2, #2).

Replace

1. Connect the interface cable to the drive (see Figure 2, #2).
2. Position the clamp holding the interface cable and replace the screw (see Figure 2, #1).
3. Position the bottom cover and replace the four screws (see Figure 1, #1).

WARNING: Make sure the Macintosh is powered off before connecting the disk drive to the built-in port. Failure to do so can result in damage to the Disk Drive and/or the Macintosh Logic Board.

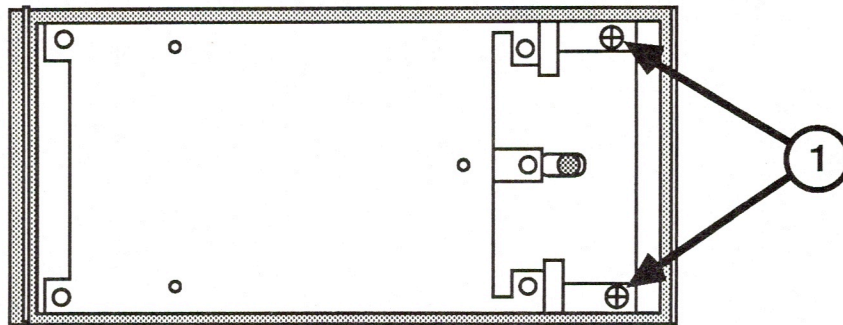


FIGURE 3

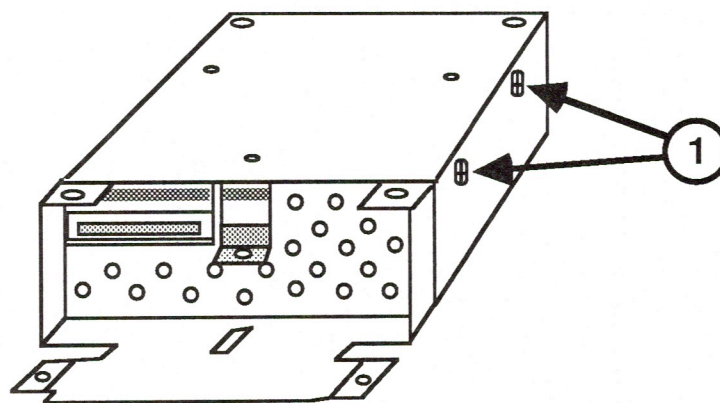


FIGURE 4

REMOVE AND REPLACE THE DRIVE ASSEMBLY

Remove

1. Remove the bottom cover and the interface cable.
2. Remove the two screws (see Figure 3, #1).
3. Lift the drive assembly from the top cover.
4. Remove the four screws that hold the drive assembly in the housing. There are two screws on each side. Figure 4, #1, shows one side.
5. Slide the drive assembly out of the housing.

Replace

1. Position the housing top up and slide the drive assembly, connectors first, into the housing. The drive assembly fits snugly between the screw mounts on the housing.
2. Start the four screws that hold the drive assembly in place. After all four screws are started, tighten each one. There are two screws on each side of the housing. Figure 4, #1, shows one side.
3. Position the drive assembly on the top cover so the screw holes line up. Replace the two screws (see Figure 3, #1).
4. Replace the interface cable and the bottom cover.

WARNING: Make sure the Macintosh is powered off before connecting the disk drive to the built-in port. Failure to do so can result in damage to the Disk Drive and/or the Macintosh Logic Board.

Macintosh External Disk Drives Technical Procedures

Section 3

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Macintosh External Disk Drives, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

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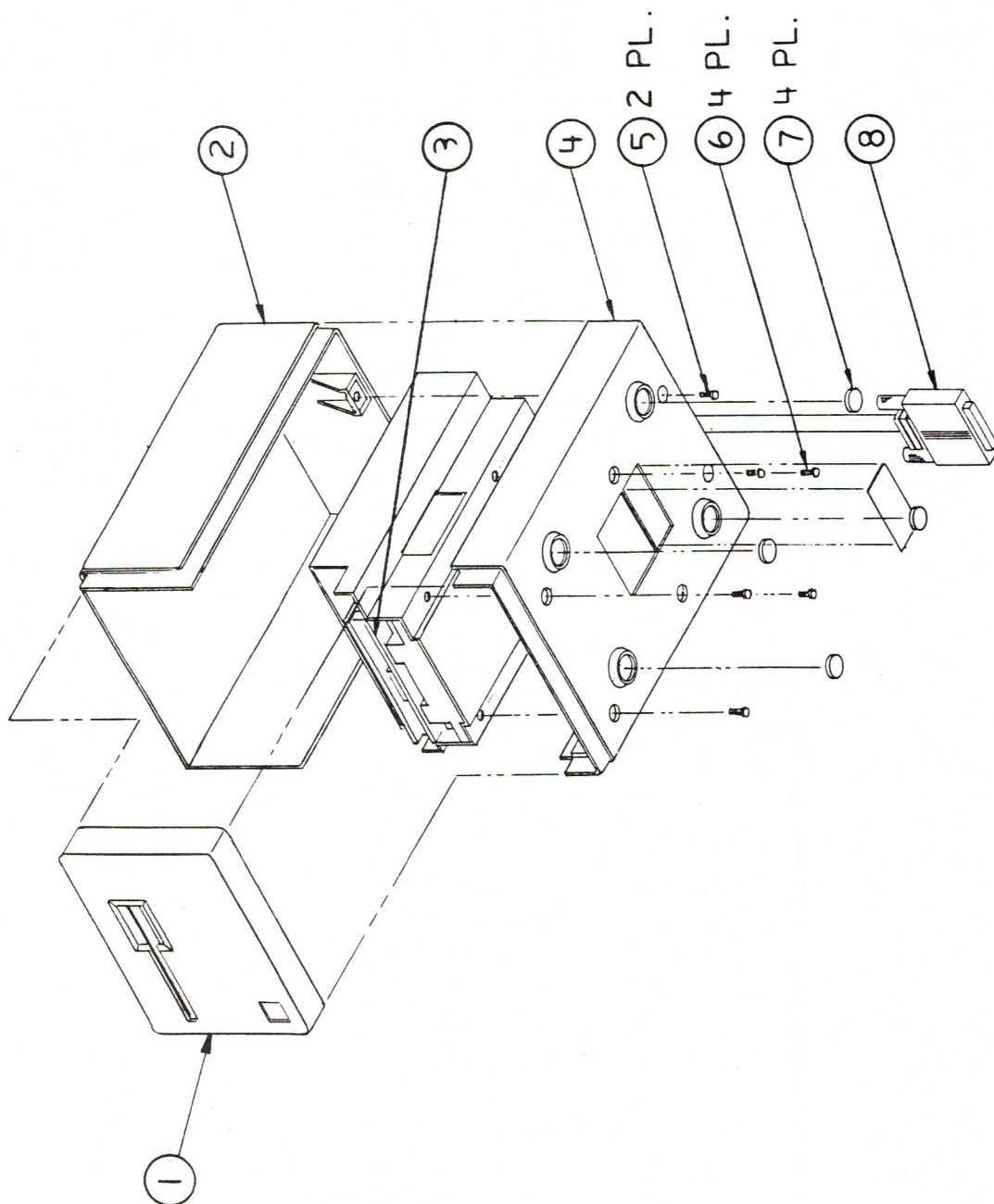
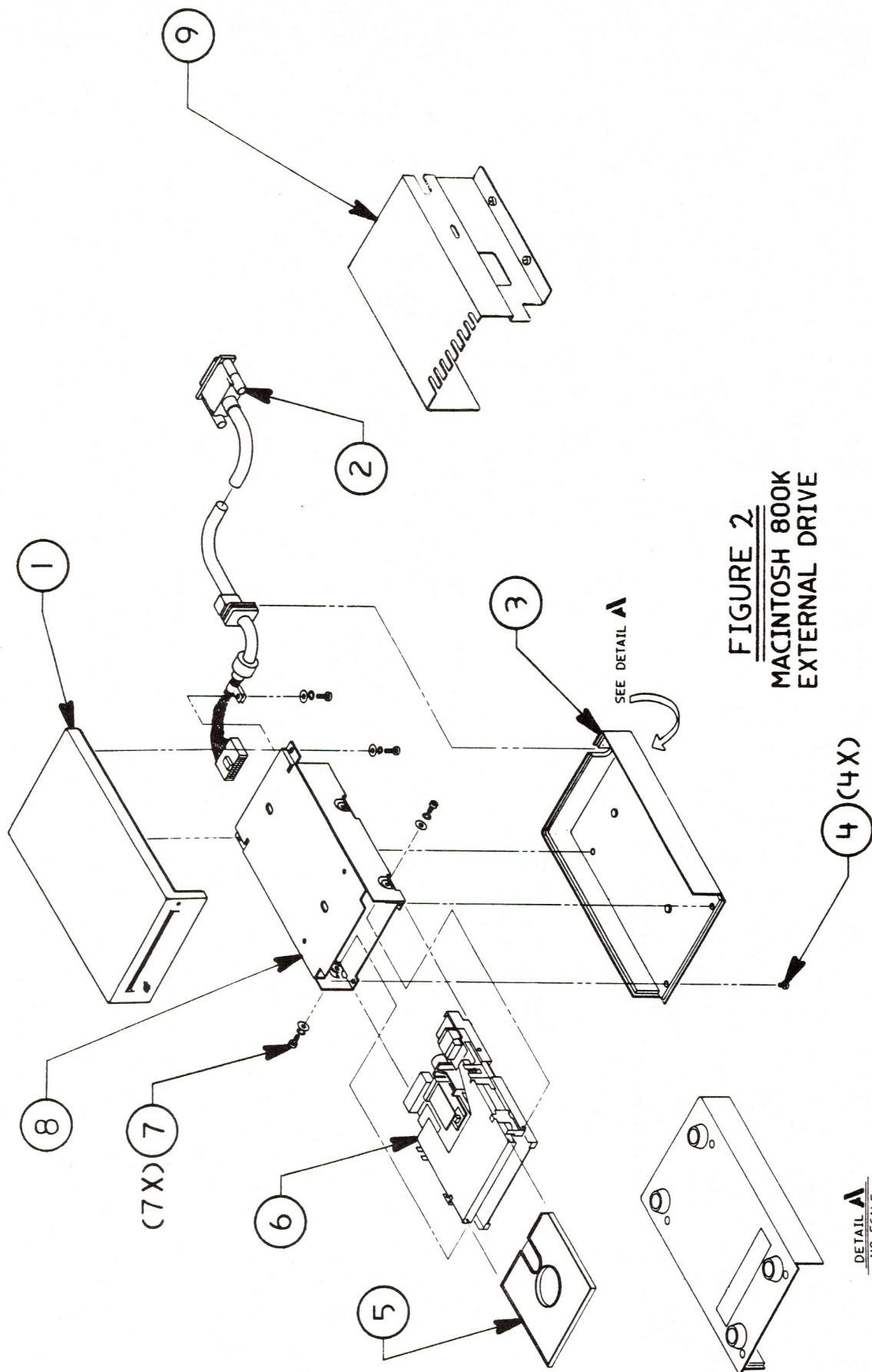


FIGURE 1

MACINTOSH EXTERNAL DISK DRIVE (400K) - Figure 1

Item	Part No.	Description
1	815-0798	Bezel, Macintosh External 400K Drive
2	815-0796	Upper Cover, Macintosh External Drive
3	661-76156	Micro Disk Assembly
4	815-0795	Lower Cover, Macintosh External Drive
5	424-1001	Screw, Tap M2.9 x 1.06 x 13
6	467-3000	Screw, M3.5 x 10
7	865-0051	Macintosh Foot
8	590-0183	Macintosh External Drive Cable



MACINTOSH 800K EXTERNAL DISK DRIVE - Figure 2

Item	Part No.	Description
1	630-5180	Top Case Assembly, 800K Drive
2	590-0255	External Drive Cable, 800K
3	630-5181	Bottom Case Assembly, 800K Drive
4	416-1305	Screw, Torx, 800K External Drive
5	003-0003	Packing Disk (for transporting)
6	661-0345	800K Mechanism, Apple 3.5 Drive
7	462-3401	Screw, M3x6, w/two washers, 800K
8	948-0022	Shield, 800K External Drive
9	805-0217	Shipping Fixture (Shield for Internal Drive) - used for transporting the 800K mechanism

End of Macintosh
External Disk Drive
Section Start of Hard
Disk 20 Section

HARD DISK 20 TECHNICAL PROCEDURES

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Hard Disk 20 Technical Procedures

Section 1

Basics

Contents:

Introduction.....	1.2
Setting Up.....	1.2
Initializing.....	1.3

INTRODUCTION

The Hard Disk 20 gives the Macintosh™ personal computer 20 megabytes of storage. Twenty megabytes equals about 50 single-sided 3 1/2 inch diskettes. The Hard Disk 20 is connected to the external drive port on the back of the Macintosh. If you need more storage, you can link another Hard Disk 20 or an external disk drive to the first Hard Disk 20 connected.

SETTING UP

NOTE: The Hard Disk 20 is a mechanical device with moving parts. Rough handling such as jarring or bumping, especially while the hard disk is running, can cause a mechanical failure or damage stored information.

Connecting and Switching On the Hard Disk 20

1. Make sure power is off to both the Hard Disk 20 and the Macintosh.
2. Attach the interface cable from the Hard Disk 20 to the external drive port on the rear of the Macintosh.
3. Attach the Hard Disk 20 power cord to the hard disk, and plug the power cord into a three-prong AC outlet.
4. Power on the Hard Disk 20. (The Macintosh should be off.)

The hard disk will whir and chirp. In 15 seconds the green light in front should be steady (unblinking).

5. For the Macintosh 512K (or 128K):

Insert the Hard Disk 20 Startup diskette into the internal drive on the Macintosh and power on the system.

If the Hard Disk 20 has already been initialized, the Macintosh will eject the Hard Disk 20 Startup diskette, and the desktop will appear with a hard disk icon in the upper right-hand corner.

If the Hard Disk 20 is damaged or uninitialized, the Macintosh will give you options to repair it or initialize it.

For the Macintosh Plus:

Power on the Macintosh Plus, and the desktop will appear with a hard disk icon in the upper right-hand corner.

If the Hard Disk 20 is damaged or uninitialized, the Macintosh Plus will display a diskette icon with a flashing question mark on the screen.

Switching Off the Hard Disk 20

IMPORTANT: Never switch off the power if the green light is blinking. You may lose information on the hard disk.

1. If you are working with an application program, quit and return to the desktop.
2. Wait till the green light is steady and unblinking. Power off the Hard Disk 20.
3. Power off the Macintosh.

INITIALIZING

If you need to reinitialize (or erase) the hard disk, everything stored on the hard disk will be removed permanently. This is the major reason for keeping backup diskettes. Refer to "Startup Problems" in **Section 3, Troubleshooting**, before you reinitialize the hard disk.

If the customer has not backed up his files and the hard disk will not come ready after following the troubleshooting flowcharts, the information that was stored is gone.

To reinitialize a Hard Disk 20:

1. Pull down the **Special** menu and select **Erase Disk**.
2. Copy the **System Folder** from the Hard Disk 20 Startup diskette onto the hard disk icon in the upper right-hand corner.
3. Copy any applications and backup files onto the hard disk.

Hard Disk 20 Technical Procedures

Section 2

Diagnostics

Contents:

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INTRODUCTION

The Hard Disk Drive Diagnostic is a pass/fail functionality test. It runs a self-test, ID test, random single block test, random multiblock read test, and scandrive test.

NOTE: Before running the diagnostic, make a backup copy of the Hard Disk Drive Diagnostic diskette. For information on making disk copies, refer to the Macintosh Owner's Manual.

DIAGNOSTICS

Equipment Needed

Known-good Macintosh
Known-good Hard Disk Drive Diagnostic diskette
Questionable Hard Disk 20

Running the Test

1. Set up the hard disk and the Macintosh (refer to **Section 1, Basics**).
2. Insert the Hard Disk Drive Diagnostic diskette.

The diskette icon should appear in the upper right-hand corner.
3. Turn on the Hard Disk 20.
4. Double click on the diskette icon.
5. Double click on the **Hard Disk Drive Diagnostic Test** icon. After a few moments, the test window will appear.
6. The type of drive to be tested is shown in the title bar of the window. To switch types, choose the type of drive from the **Drive** menu.
7. From the test window, you may select:
 - The short 15-minute test;
 - The extended overnight test (20 iterations of the short test).

Make your test-length selection by clicking in the appropriate box.

8. Click the **Start** button. The diagnostic will go through various tests. The **Notes** box at the bottom of the window will display the progress of the test.

You may stop the test at any time by clicking the **Stop** button. If you click on the **Pause** button, the test will pause until you click on the **Continue** button.

At the end of the test, a dialog box will give you pass/fail information for the drive tested. Click **OK** to return to the test window.

You may quit the diagnostic program at any time (if the test is not running) by choosing **Quit** from the **File** menu.

If the hard disk fails the diagnostic, refer to **Section 3, Troubleshooting**.

Hard Disk 20 Technical Procedures

Section 3

Troubleshooting

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INTRODUCTION

This troubleshooting guide contains a flowchart and a table of explanations for the flowchart.

Read **Things to Remember** before you begin troubleshooting. There are numerous things you need to know about the Hard Disk 20 in order to troubleshoot it effectively.

THINGS TO REMEMBER

The Hard Disk 20 has a total of three exchange modules: the controller card; the power supply; and the hard disk assembly, which consists of the hard disk and the analog card. At first glance the Hard Disk 20 may appear to be simple to troubleshoot; however, there are a few important things you need to do and be aware of before starting.

1. Be sure to stress to your customers the importance of backing up all files on diskette. This will make your job easier and the customer a lot happier if the hard disk becomes faulty.
2. If the customer has not backed up his files but you can get the hard disk to come ready by following the troubleshooting flowchart, you may still be able to recover some or all of his data by following the procedures in "Startup Problems" (in this section). **Do not reinitialize (or erase) the hard disk until you have tried all possible data recovery procedures.** Once you reinitialize (or erase), everything stored on the hard disk is removed permanently.

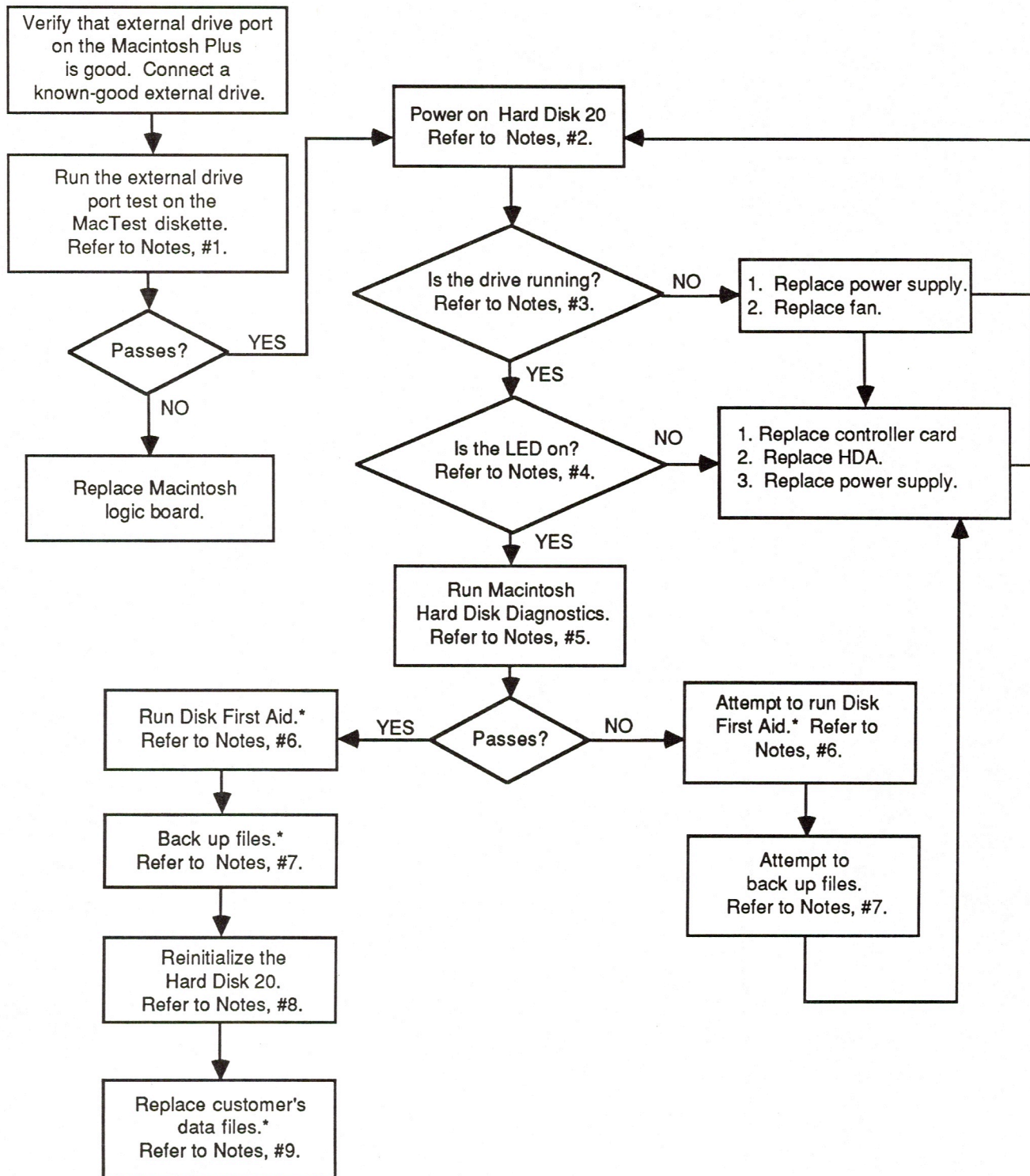
If the hard disk will not come ready after you have followed the procedures in the troubleshooting flowchart, there is no way to recover the data.

3. Be sure to test on a **known-good** Macintosh. Once the hard disk is functioning properly, test it with the customer's Macintosh.
4. When returning the hard disk assembly for exchange, it **must be** shipped in Apple-approved packaging. Save the exchange hard disk assembly boxes and packaging materials for future use.

5. With a Macintosh Plus, a Hard Disk 20 Startup diskette is not necessary.

CAUTION: The interface cable from the controller board to the hard disk is not a standard ribbon cable. Do not substitute a different ribbon cable for this connection. Replace only with the specified cable from the parts list.

HARD DISK 20 TROUBLESHOOTING FLOWCHART



NOTES

Perform steps marked with an asterisk (*) only if the customer has not backed up his data files.

1. This step verifies that the external drive port on the system is functioning correctly. Refer to **Macintosh Technical Procedures, Section 2, Diagnostics**, for complete information on running the external drive test.
2. Power on the Hard Disk 20. Do not turn on the system until told to do so.
3. You should hear the hard disk come up to operating speed. Verify that the fan is working by looking at it on power up with the top cover removed.
4. The LED is on when the hard disk is ready. It flashes when the heads are moving. If the light is not on and steady after 60 seconds, this usually indicates that the HDA assembly is bad.
5. Refer to **Section 2, Hard Disk 20 Diagnostics**.
- *6. Disk First Aid is a program that attempts to repair the file structure on the hard disk. Refer to "Startup Problems" in this section for instructions.
- *7. Back up as many files as possible before continuing.
8. To reinitialize the hard disk, refer to **Section 1, Basics**.
- *9. After initializing the hard disk, copy the customer's data from diskettes back onto the hard disk.

APPENDIX - SPECIAL PROBLEMS

Startup Problems

NOTE: These procedures will cure failures due to software (Finder) problems. They do not address hardware problems, which may be the original cause of the problem. Refer to the Hard Disk 20 Troubleshooting Flowchart for possible hardware causes.

If the Finder program on the Hard Disk 20 is corrupted, the following four symptoms will appear when you attempt to start up from the Hard Disk 20:

- a. The system will fail to complete its startup.
- b. The diskette will be ejected.
- c. The Macintosh and the Hard Disk 20 will lock up (will not accept mouse or keyboard input).
- d. The Hard Disk 20 icon will not be present on the desktop.

Perform the following four procedures one at a time, in the order listed, to attempt to correct any or all of the problems listed above.

1. Run Disk First Aid on the Hard Disk 20.

Disk First Aid can be used to repair any hard disk or double-sided 800K diskette that uses the Macintosh hierarchical file system (HFS).

Disk First Aid is included on the Hard Disk Drive Diagnostic diskette for the Macintosh. The diskette must be used as the startup diskette.

To repair a Hard Disk 20:

- a. Insert the Hard Disk Drive Diagnostic diskette into the internal drive of the Macintosh. Power on the Macintosh first, then the Hard Disk 20.
- b. Open the diskette icon, then the **Disk First Aid** icon.
- c. A display window will list one of the attached drives. Click on **Drive** to change selections. When the Hard Disk 20 is listed, click on **Open**.

A second screen will appear listing the volume name

- d. Select **Repair Automatically** from the **Options** menu.
- e. Click on **Start** to begin the repair and verification process. You may stop the application at any time by clicking on the **Stop** button. Or you may choose **Pause**, then **Resume**.
- f. When the Hard Disk 20 has been repaired and/or verified, pull down the **File** menu and click on **Close**.
- g. When you are finished, select **Quit** from the **File** menu.

2. Replace the Hard Disk 20's Finder File.

- a. Power off the Macintosh, and insert the Hard Disk 20 Startup diskette into the internal disk drive.
- b. Power the Macintosh on.
- c. When you see the **Welcome to Macintosh** screen, hold down the mouse button until the desktop appears and the wristwatch turns into a pointer.

The Hard Disk 20 Startup diskette is now the current startup diskette.

- d. Drag the **System** file and the **Finder** file from the **System Folder** on the Hard Disk 20 Startup diskette to the **Hard Disk 20** icon to replace the corrupted files.
- e. On completion, power off the Macintosh and start up from the Hard Disk 20 Startup diskette.
- f. Run the diagnostics.

If the problem still exists, continue to step 3.

3. Rebuild the Hard Disk 20's Desktop.

- a. Press and hold down the <Command> and <Option> keys, while you start up from the Hard Disk 20 Startup diskette. (Be sure to hold down both keys continuously during the entire booting sequence.)

A message will appear asking if you want to rebuild the Desktop file.

- b. Select OK.

The Desktop will be rebuilt. (This will take a few minutes.)

- c. Power off the Macintosh and start up from the Hard Disk 20 Startup diskette.

- d. Run the diagnostics.

If the problem still exists, continue to step 4.

WARNING: If you perform step 4, all data on the hard disk will be erased.

4. Initialize the Hard Disk 20.

- a. Press and hold down the <Command>, <Option>, and <Tab> keys while you start up from the Hard Disk 20 Startup diskette. (Be sure to hold down all three keys continuously during the entire startup sequence.)

A message will appear asking if you want the Hard Disk 20 completely erased and its contents destroyed.

- b. Select OK.

This choice erases all data on the hard disk.

- c. Run the diagnostics.

Daisy-Chaining Problems

Up to three additional hard or floppy disk drives may be "daisy-chained" to the Hard Disk 20 through the expansion port that is connected to the Hard Disk 20's controller board. If a customer has attempted to set up a daisy-chain and has found that not all of his attached devices are recognized by the Macintosh (that is, their icons don't show up on the desktop) or that their operation is intermittent or "flaky," the problem **may** be in the Hard Disk 20's expansion port linkage. Attempt to isolate the problem by using the following troubleshooting procedure:

1. Check for faulty or loose cables.
2. If the cables are OK, check to see if each of the daisy-chained drives will work when connected directly to the Macintosh.
3. If the drives function normally when connected directly to the Macintosh, then the likely cause is a faulty expansion port connector on the controller board of the first Hard Disk 20 in the chain, and the controller board must be replaced.

Hard Disk 20 Technical Procedures

Section 4

Take-Apart

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Top Cover.....	4.3
Controller Board.....	4.5
Bottom Shield.....	4.7
Fan.....	4.9
Power Supply.....	4.11
Hard Disk Assembly.....	4.13

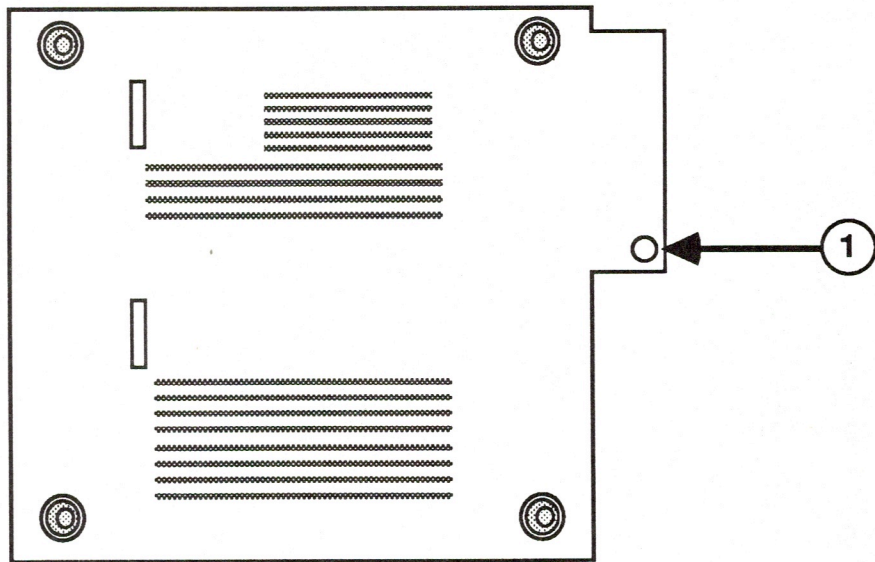


FIGURE 1

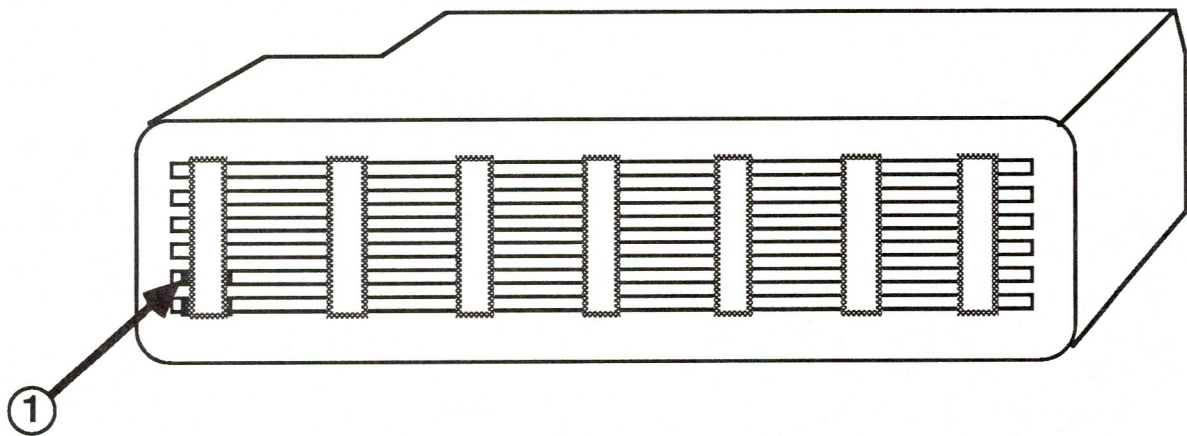


FIGURE 2

TOOLS NEEDED

The following will be needed for the take-apart procedures:

- Macintosh pull-apart tool
- Macintosh torx driver
- A #2 phillips screwdriver
- A jeweler's screwdriver
- A medium flathead screwdriver

REMOVE AND REPLACE TOP COVER

Remove

1. Gently place the Hard Disk 20 upside down.
2. Remove the one torx screw shown in Figure 1, #1.
3. Locate the two tabs, one on each side of the hard disk (see Figure 2, #1).
4. Gently insert a jeweler's screwdriver to release one of the tabs, and use the Macintosh pull-apart tool to lift the cover up. Repeat this for the other side of the hard disk.
5. Pull the cover back and lift it free.

Replace

1. Slide the cover towards the front and gently push it into place.

You will hear a "pop" when the tabs interlock.

2. Replace the screw shown in Figure 1, #1.

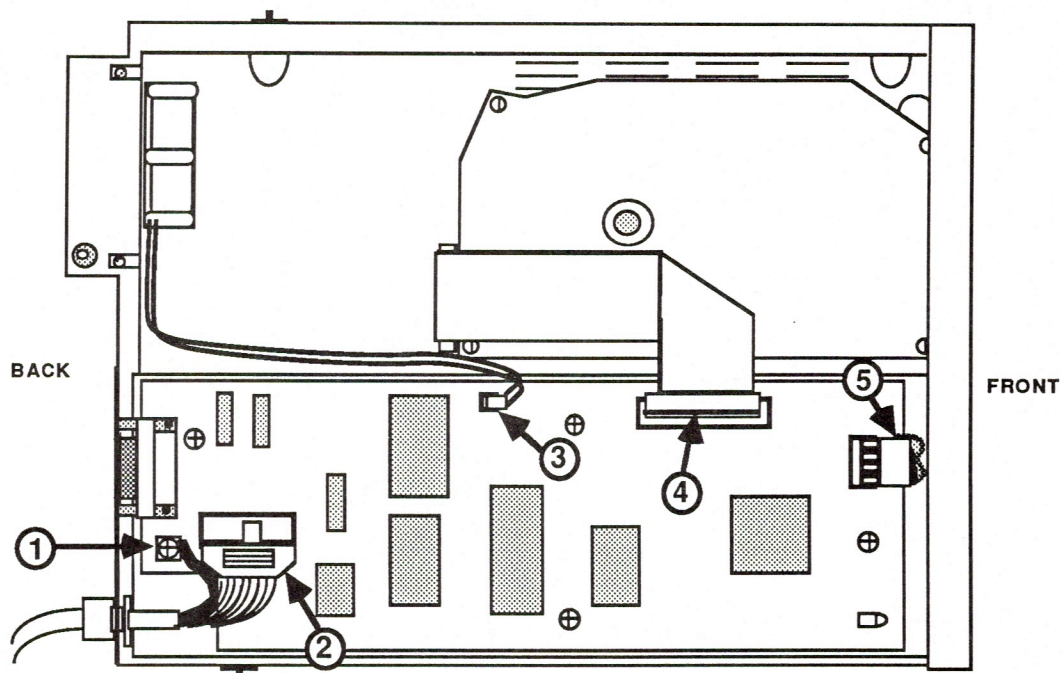


FIGURE 3

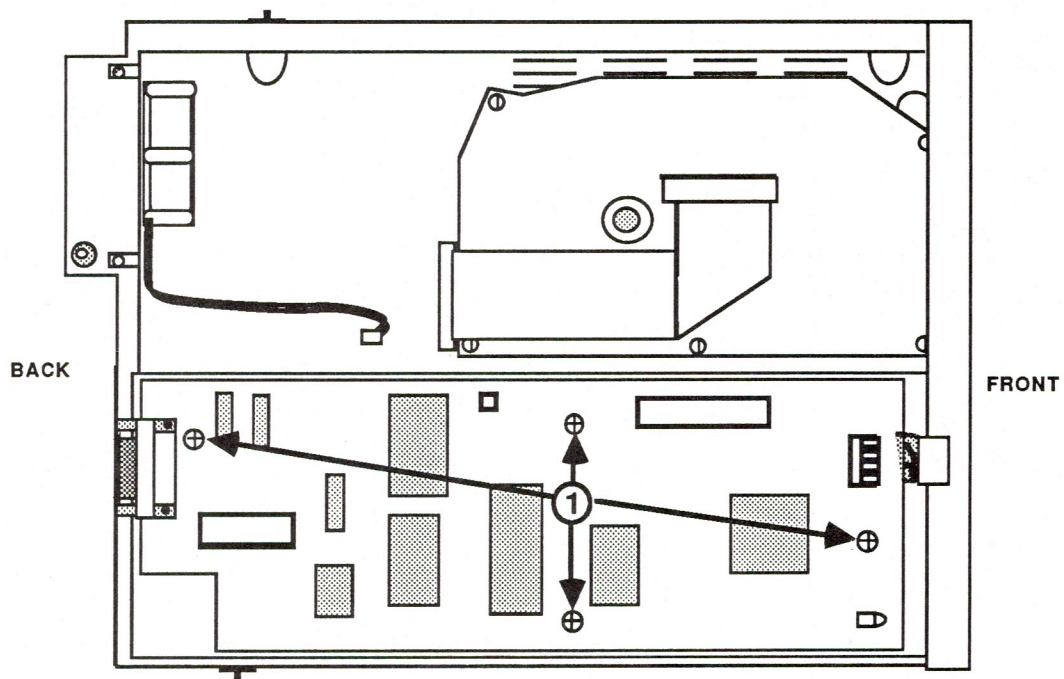


FIGURE 4

REMOVE AND REPLACE THE CONTROLLER BOARD

Remove

1. Remove the top cover.
2. Remove the grounding screw (see Figure 3, #1).
3. Disconnect the interface cable and remove it (see Figure 3, #2).
4. Unplug the fan connector (see Figure 3, #3).
5. Disconnect the interface cable from the controller board to the hard disk (see Figure 3, #4).
6. Unplug the power supply connector (see Figure 3, #5).
7. Remove the four screws (see Figure 4, #1).
8. Lift off the controller board.

Replace

1. Place the controller board on top of the power supply so the standoffs line up.
2. Replace the four screws (see Figure 4, #1).
3. Plug in the power supply connector (see Figure 3, #5).
4. Connect the interface cable from the hard disk to the controller board (see Figure 3, #4).
5. Plug in the fan connector (see Figure 3, #3).
6. Reposition the interface cable and connect it (see Figure 3, #2).
7. Replace the grounding screw (see Figure 3, #1).
8. Replace the top cover.

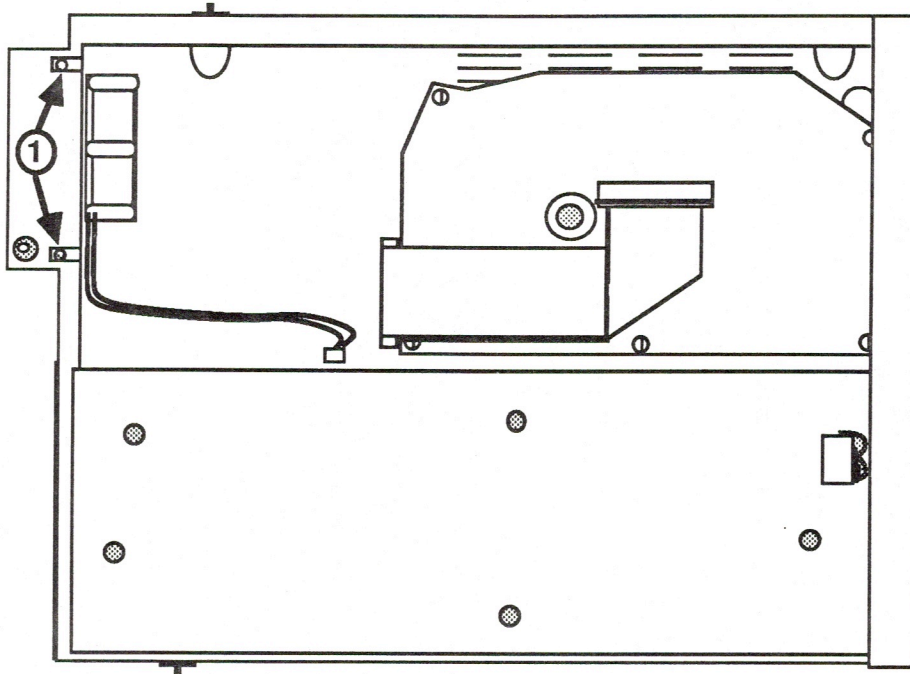


FIGURE 5

REMOVE AND REPLACE BOTTOM SHIELD

Remove

1. Remove the top cover.
2. Remove the controller board.
3. Remove the two screws (see Figure 5, #1).
4. Gently tilt and lift the bottom shield (with the power supply and hard disk attached) out of the plastic case.

Replace

1. Gently position and place the bottom shield (with the power supply and hard disk attached) into the plastic case.
2. Replace the two screws (see Figure 5, #1).
3. Replace the controller board.
4. Replace the top cover.

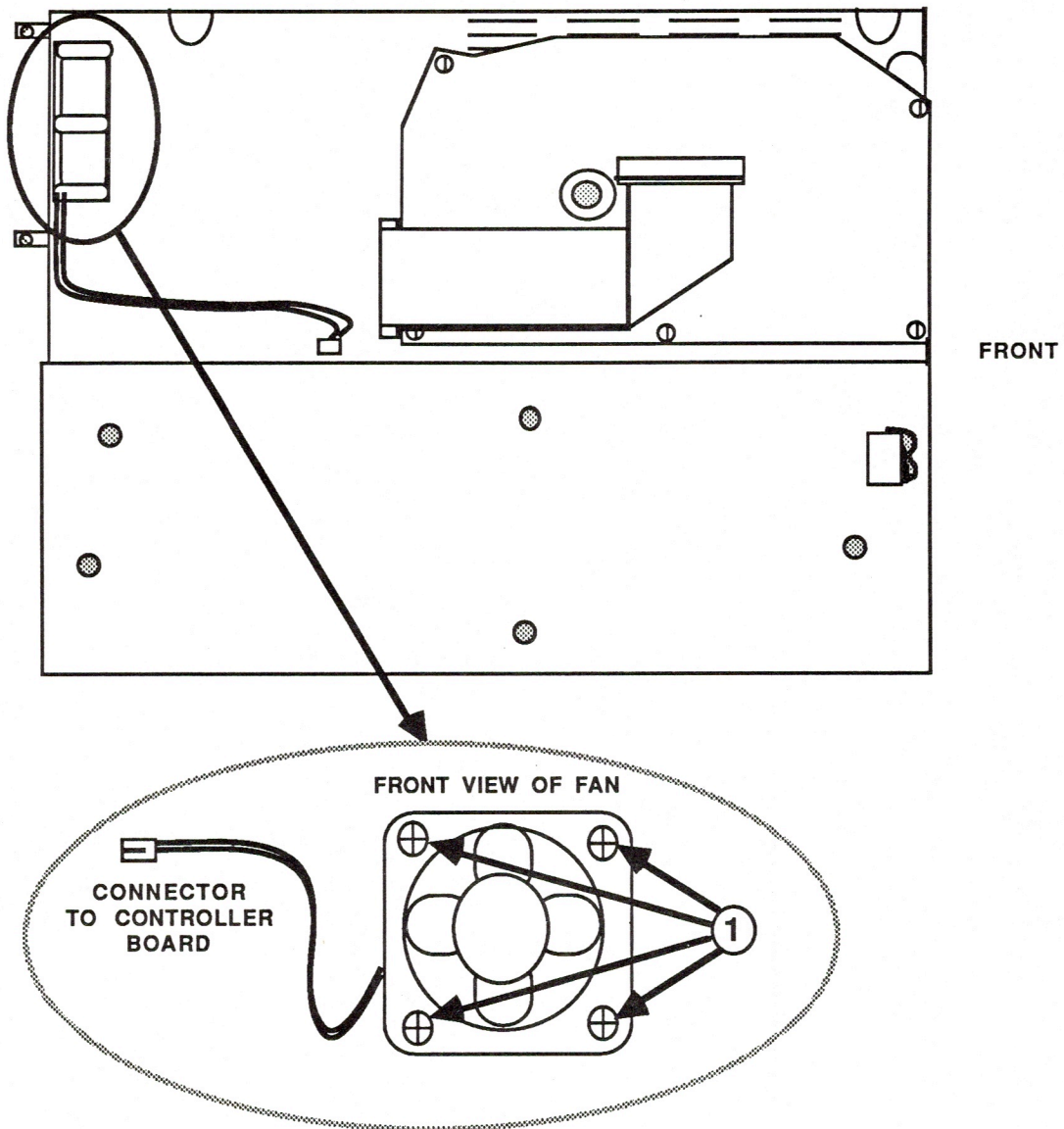


FIGURE 6

REMOVE AND REPLACE THE FAN

Remove

1. Remove the top cover.
2. Remove the controller board.
3. Remove the bottom shield.
4. Remove the four screws holding the fan in place (see Figure 6, #1).
5. Remove the fan.

Replace

1. Position the fan so that the air flow arrow embossed on the side of the fan is pointing to the rear of the machine and the rotation arrow embossed on the side of the fan is pointing up.
2. Replace the four screws (see Figure 6, #1).
3. Replace the bottom shield.
4. Replace the controller board.
5. Replace the top cover.

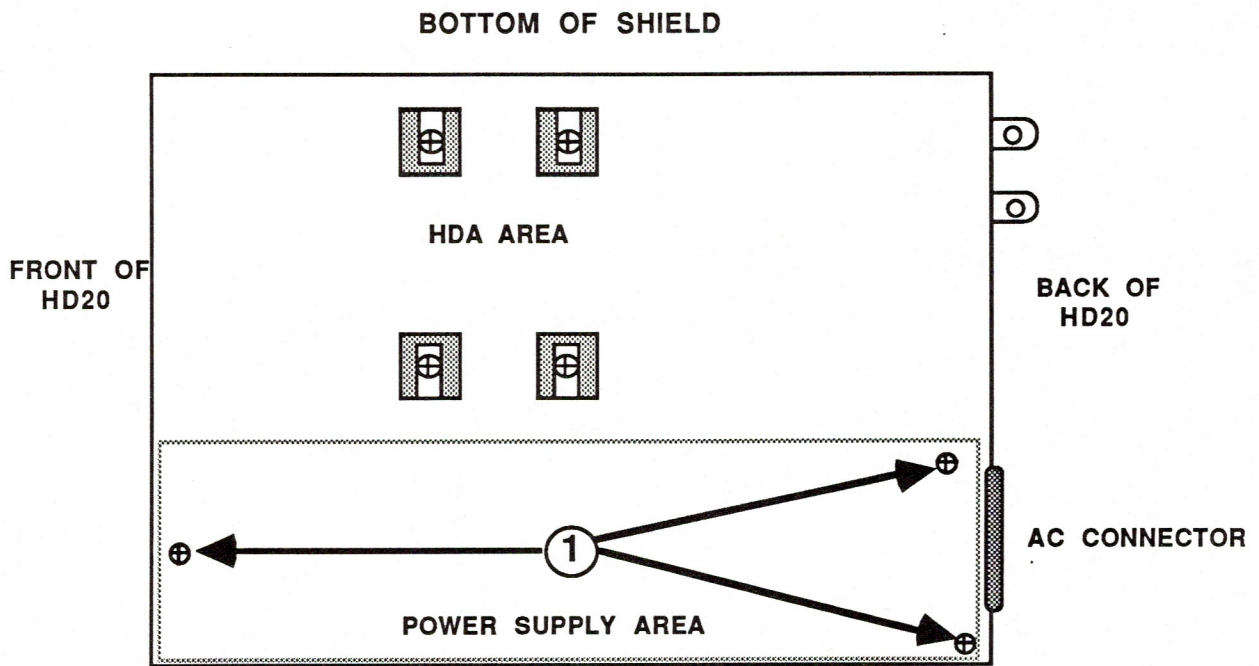


FIGURE 7

REMOVE AND REPLACE THE POWER SUPPLY

Remove

1. Remove the top cover.
2. Remove the controller board.
3. Remove the bottom shield with the hard disk and power supply from the plastic case.
4. Gently place the bottom shield upside down.
5. Remove the three screws (see Figure 7, #1).
6. Remove the power supply.

Replace

1. Position the power supply so that the screw holes line up.
2. Replace the three screws (see Figure 7, #1).
3. Replace the bottom shield with the hard disk and power supply into the plastic case.
4. Replace the controller board.
5. Replace the top cover.

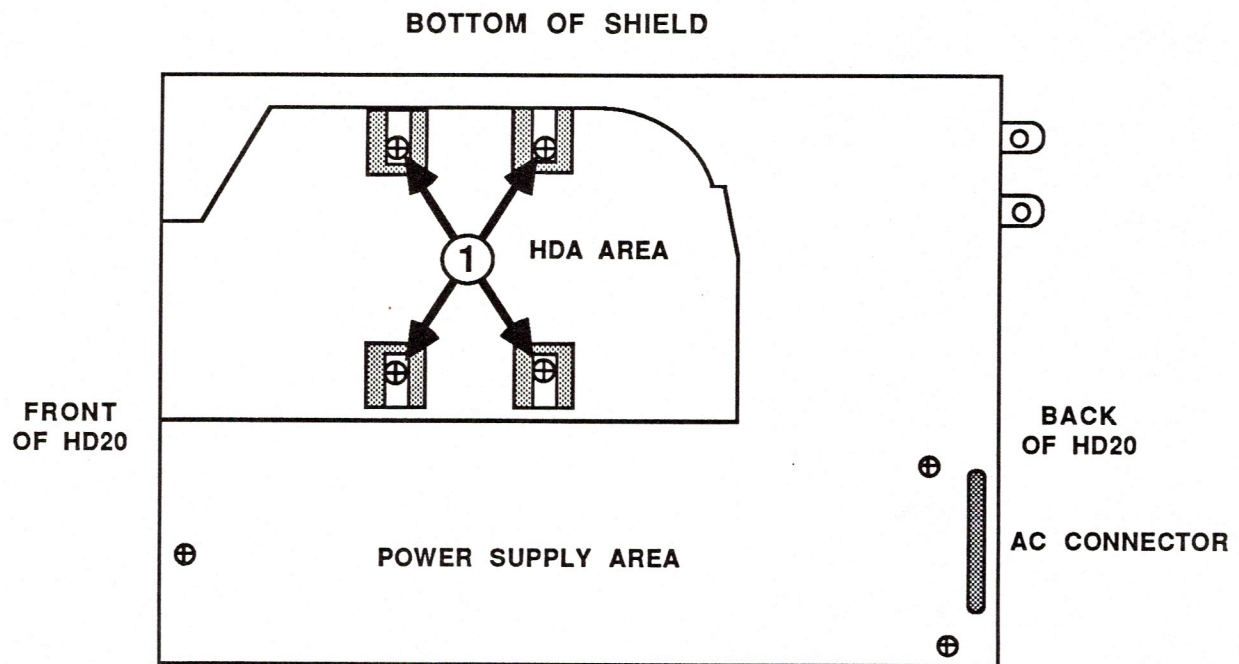


FIGURE 8

REMOVE AND REPLACE THE HARD DISK ASSEMBLY

Remove

1. Remove the top cover.
2. Remove the controller board.
3. Remove the bottom shield (with the hard disk and power supply attached) from the plastic case.
4. Gently place the bottom shield upside down.

CAUTION The interface cable from the controller board to the hard disk is not a standard ribbon cable. Do not substitute a different ribbon cable for this connection. Replace only with the specified cable from the parts list. Failure to do this can result in serious damage to the hard disk and/or controller board.

5. Remove the interface cable.
6. Remove the four screws (see Figure 8, #1).
7. Remove the hard disk assembly.

Replace

1. Position the hard disk assembly so the screw holes line up with the bottom shield.
2. Replace the four screws (see Figure 8, #1).
3. Connect the interface cable to the hard disk assembly.
4. Replace the bottom shield (with the hard disk and power supply attached) into the the plastic case.
5. Replace the controller board.
6. Replace the top cover.

Hard Disk 20 Technical Procedures

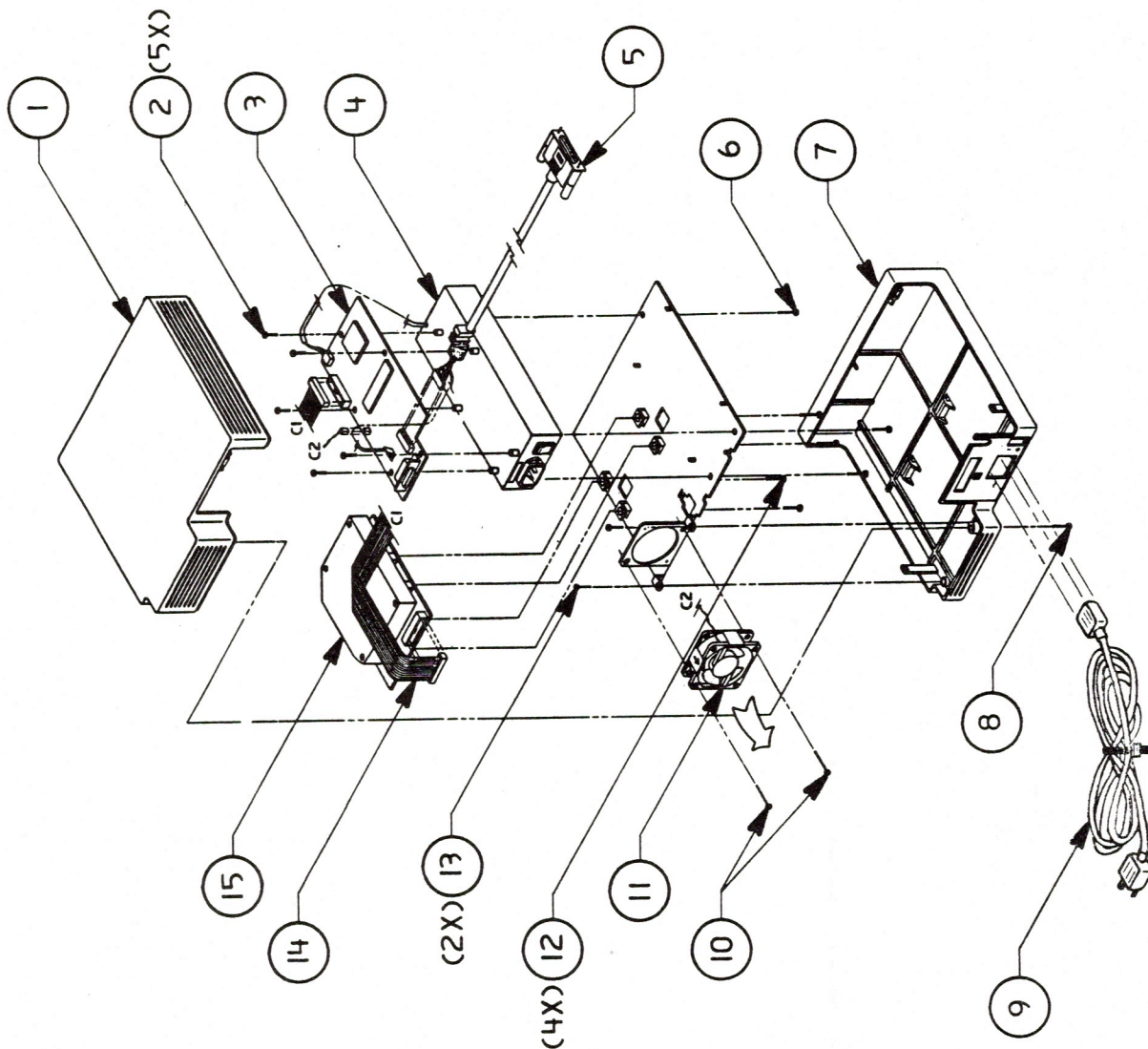
Section 5

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Hard Disk 20, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

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HARD DISK 20

Item	Part No.	Description
1	815-0923	Top Cover
2	410-1306	Screw (controller + lug)
3	661-0300	HD 20 Controller Board
4	661-0301	HD 20 Power Supply
5	590-0324	Cable, HD 20 to Macintosh
6	415-3306	Screw (power supply)
7	630-5193	Bottom Cover
8	422-1007	Screw (case)
9	590-0260	Cable, Power
10	462-3103	Screw (fan)
11	720-5001	Fan
12	440-6105	Screw (Rodime)
13	462-4100	Screw (chassis to plastic)
14	590-0336	Cable, HDA to Controller
15	661-0302	HDA, 20 Meg, with Analog Board

**End of Hard Disk 20
Section Start of High-
Res Monochrome
Monitor Section**

High-Res Monochrome Monitor

Technical Procedures

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	2.20	Chassis Assembly
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**Section 4 –
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- 4.2 Introduction
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**Illustrated
Parts List**

- IPL.3 Internal Assembly (Figure 1)
- IPL.5 CRT Case Assembly (Figure 2)

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High-Res Monochrome Monitor

Section 1 – Basics

□ CONTENTS

- 1.2 Product Description
- 1.3 Safety Precautions
 - 1.3 Safe Electrical Setup
 - 1.4 CRT Safety Rules
 - 1.6 Live Adjustment Rules
- 1.7 Disposing of the Cathode-Ray Tube (CRT)

□ PRODUCT DESCRIPTION

The Apple® High-Res Monochrome Monitor is a 12-inch monitor that provides a high-resolution black and white display for the Macintosh II. The monitor features 640 x 480 resolution, a universal power supply, and glare protection.

The power switch (Figure 1, #1), contrast control (Figure 1, #2), and brightness control (Figure 1, #3) are the only controls recommended for user access. The LED on the lower front case indicates when the power is on.

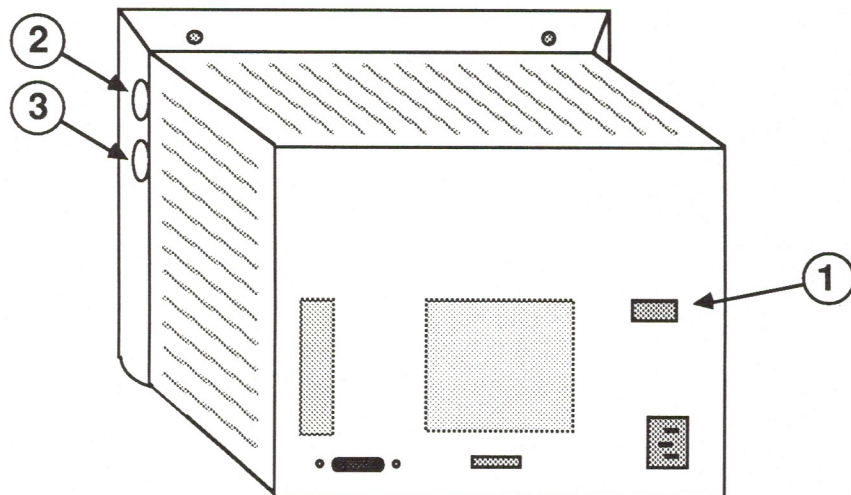


FIGURE 1

□ SAFETY PRECAUTIONS

The Apple High-Res Monochrome Monitor is harmless as long as you're just watching the display. Once you remove the cover, however, you are exposed to the high-voltage Cathode-Ray Tube (CRT)—the picture tube. The following precautions must be taken to ensure your safety, especially when you are making adjustments on a live monitor.

Safe Electrical Setup

- **Be sure your outlet is correctly wired and properly grounded.**

Polarity and ground testers are available from most electronics stores. Test all outlets in your service shop before working on **any** electrical equipment. If you have any doubts about your building's wiring, consult a qualified electrician.

- **Never use an adaptor plug to connect a monitor's three-prong power plug to a two-prong wall outlet.**

Adaptors defeat the ground pin, which is a safety feature.

- **When performing live adjustments, use an isolation transformer between the monitor and the outlet.**

Order an isolation transformer from your electronics distributor, and make it a practice to use it whenever you are working with **any** charged monitor or other powered system under test. An isolation transformer isolates the circuitry of the system under test from the power company's circuitry, thus reducing the likelihood of a fatal shock should you simultaneously contact high voltage and anything else that is earth grounded.

Do not connect more equipment to the transformer than the wattage capacity of the transformer will bear. (It is usually best to connect only one piece of equipment at a time.) We recommend an isolation transformer with a minimum wattage capacity of 500 VA, with grounded three-prong cord and receptacle. Two such transformers, available from many electronics stores and distributors, are listed below:

Triad N-57M

Stancor GIS 500

CRT Safety Rules

- **Do not work on a monitor alone.**

If there is an accident, it could save your life to have someone else nearby. Apple recommends that your staff be trained in cardio-pulmonary resuscitation (CPR).

- **Remove rings, wristwatches, bracelets, hanging necklaces, and other jewelry before performing repairs on a monitor.**

Metal jewelry is an excellent conductor of electricity. Removing jewelry will reduce the possibility of electric shock.

- **Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments.**

Grounding wriststraps, heelstraps, and mats are used to protect sensitive components from the damaging effects of electrostatic discharge from your own body or clothing. Even though they contain a one-megohm resistor and are designed to conduct only small electrical charges, we recommend that they be used **only** when working on "dead" (uncharged) equipment.

- **Wear safety goggles when working with a CRT.**

The CRT contains a high vacuum. If cracked or broken, it can implode (collapse into itself), then explode. To protect your eyes from serious injury, always wear safety goggles when working on or near a CRT, and be careful of other people in the area.

- **Before working inside a monitor, turn off the power and disconnect the AC power cord.**

Certain parts of a monitor chassis are **hot** (electrified) when the monitor is under power. Except when you **must** have the power on (for example, when making live adjustments), never work on a plugged-in monitor—even if you have the power turned off.

- **Keep one hand in your pocket or behind your back when working on a live monitor.**

This practice reduces the risk of current passing through your heart, should you accidentally contact high voltage.

- **Always discharge the anode before touching anything inside the monitor.**

The High-Res Monochrome Monitor has a bleeder resistor on the anode that drains the charge when the power is turned off. **Nevertheless, in case the resistor fails and leaves the anode fully charged, you must perform the discharge procedure before working inside the monitor.**

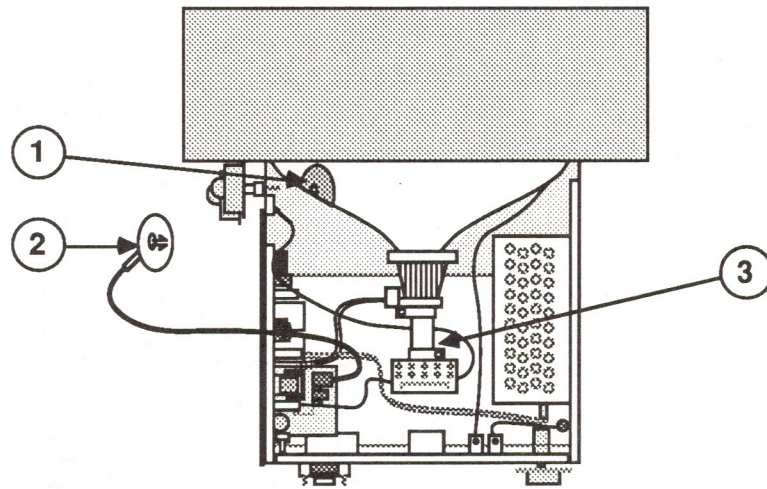


FIGURE 2

- **Never touch the anode connector or the anode aperture.**

Normally the anode aperture (Figure 2, #1) has a connector plugged into it (Figure 2, #2). When a CRT is replaced, the anode connector is removed, exposing the anode. If the bleeder resistor fails, the anode can retain a charge of several thousand volts (even when power is off), and can regain some charge even after it has been discharged.

- **Do not pick up or handle a CRT by its neck.**

To prevent an implosion, you should take every precaution against breaking the tube, especially at the neck (Figure 2, #3) where the tube is the thinnest.

Live Adjustment Rules

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live monitor:

- The yoke wires (Figure 3, #1)
- The anode connector (Figure 3, #2)
- The anode wire (Figure 3, #3)
- The flyback transformer (Figure 3, #4)

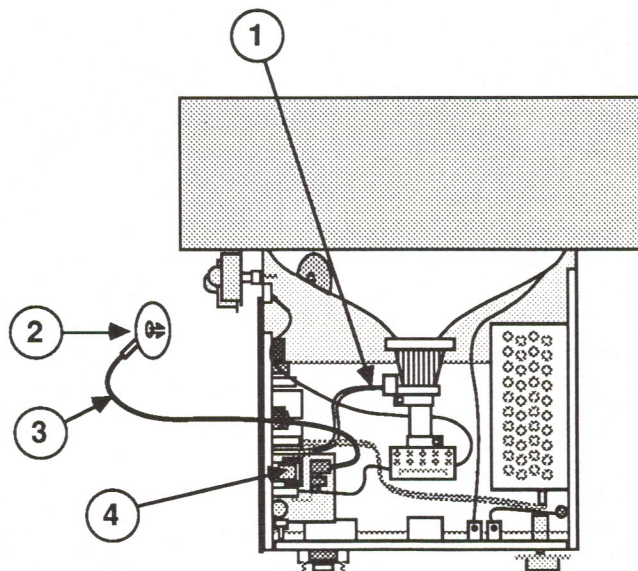


FIGURE 3

WARNING: Serious injury could result if you touch any of these components with the power on.

❑ DISPOSING OF THE CATHODE-RAY TUBE (CRT)

Remember that a CRT can implode unless it is devacuumed. Putting a defunct CRT into a trash receptacle without devacuuming it can endanger other people.

Materials Required

Thick cardboard box, large enough to conceal the CRT
Large, sharp, diagonal cutters
Large pliers
Duct tape
Safety goggles
Gardening gloves
12-inch square of cloth or heavy paper

Devacuuming the CRT

1. Put on safety goggles.
2. In the side of the box about six inches from the bottom, cut or drill a hole just large enough to accommodate the very tip of the CRT neck.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape down the box flaps with the duct tape (Figure 4).

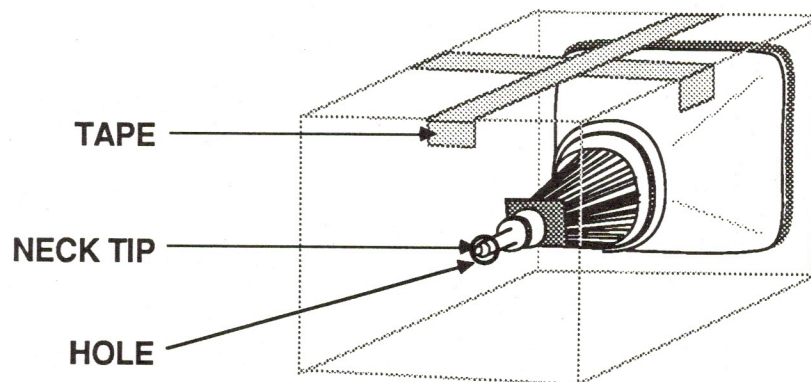


FIGURE 4

WARNING: Only the very tip of the CRT neck should be protruding through the hole in the box. The box must not have any other openings.

4. Put on the gloves.
5. Using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
6. Tape the piece of cloth or paper onto the box (Figure 5, #1) so that it forms a veil over the opening (Figure 5, #2) but allows your hand access to the tip of the CRT. The veil's purpose is to catch bits of glass that may fly during the following step.

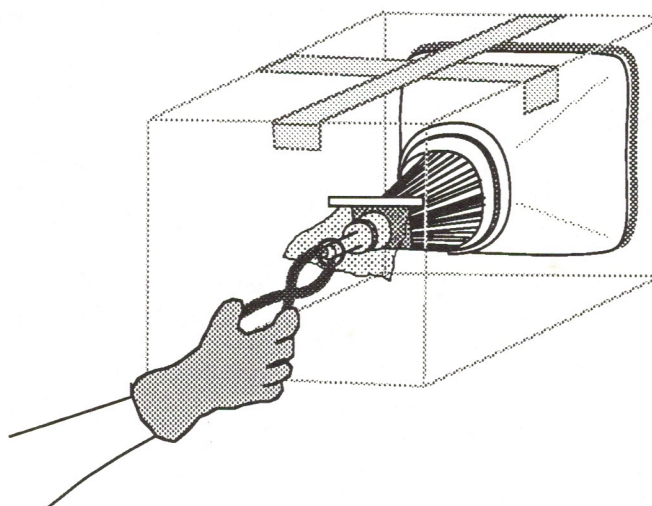


FIGURE 5

7. Make sure no one is standing nearby. Place the pliers under the veil, stand to one side, and look away while you use the pliers to snip off the exposed tip of the CRT.

WARNING: Do not look directly at the box when cutting off the tip of the CRT!

Note: You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the interior of the CRT is clearly visible through the opening created by the removed tip.

High-Res Monochrome Monitor

Section 2 – Take-Apart

☐ CONTENTS

2.3	Rear Cover
2.4	Discharging the CRT
2.6	Main Logic Board
2.10	Power Supply
2.12	Fuse
2.14	Contrast Control Board
2.16	Video Board "C"
2.20	Chassis Assembly
2.22	Cathode Ray Tube (CRT)
2.24	LED Cable Assembly
2.26	Power Switch
2.28	A/C Inlet

□ REAR COVER

Materials Required

Medium Phillips screwdriver

Remove

To remove the rear cover:

1. Turn off the monitor, and disconnect the AC power cord and the video cable from the monitor.
2. Place the monitor on its face on a soft surface to avoid damage to the CRT screen.

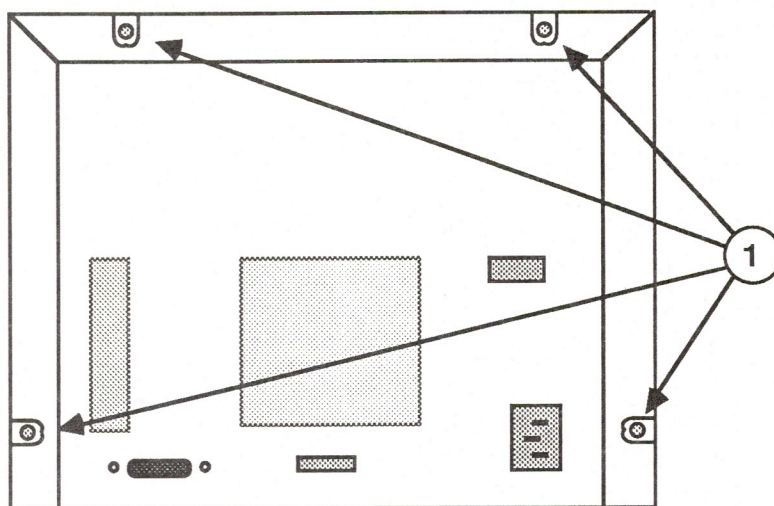


FIGURE 1

3. Remove the four screws (Figure 1, #1) from the rear cover.
4. Lift the rear cover off the CRT bezel and set it to the side.

Replace

To replace the rear cover:

1. Slide the rear cover onto the CRT bezel.
2. Replace the four Phillips screws (Figure 1, #1).

❑ DISCHARGING THE CATHODE RAY TUBE (CRT)

Materials Required

Long flatblade screwdriver
CRT discharge tool (or a 12-inch jumper wire with insulated alligator clips)
Small flatblade screwdriver
Safety goggles

Procedure

The High-Res Monochrome Monitor is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. **Nevertheless, you must follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.**

To discharge the CRT:

1. Remove the rear cover.
2. Set the monitor upright with its back facing you.
3. Remove any metal jewelry (rings, watches, bracelets, hanging necklaces, etc.) and your grounding wriststrap.
4. Put on the safety goggles.

WARNING: Use only one hand while discharging the CRT. If you are using a screwdriver, grasp only the insulated handle while discharging the RT.

5. Attach the clips of the CRT discharge tool to any part of the metal chassis that surrounds the back of the CRT (Figure 2, #1).
6. Slide the discharge tool under the anode cap (Figure 2, #1) and push it toward the center of the cap until the blade comes in contact with the metal anode ring.

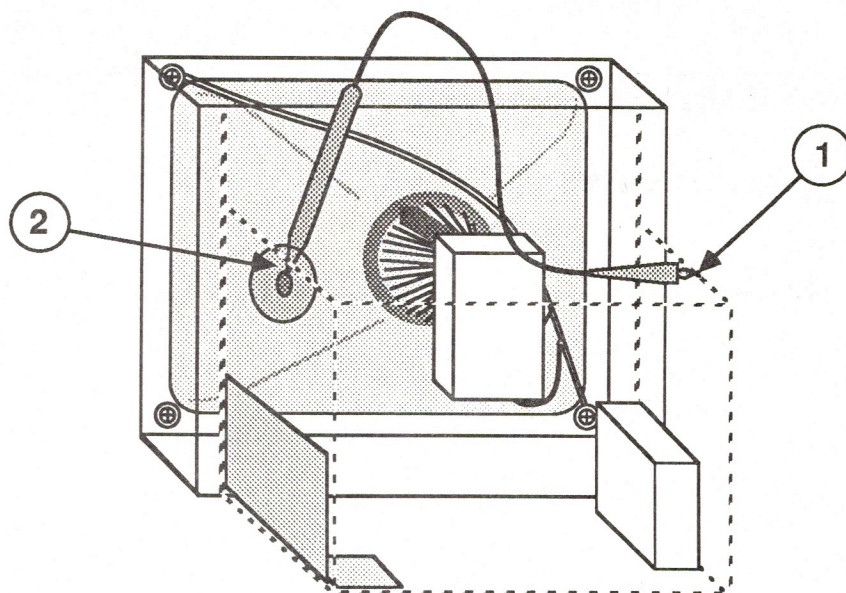


FIGURE 2

7. Remove the discharge tool and disconnect it from the metal chassis.
8. For some of the following procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode ring at the center. Look at the metal connector in the center of the cap and notice how it is clipped into the CRT. Push one side of the metal connector in and lift the cap off the tube.

Note: A secondary charge can build up even after you have discharged the CRT. If repairs are not finished within 30 minutes, the anode should be discharged again. Or, to ensure that any residual charge is dissipated during the service procedure, establish a ground lead by fastening one end of an alligator lead to the metal chassis, and the other end to the anode aperture.

□ MAIN LOGIC BOARD

Materials Required

Medium Phillips screwdriver

Remove

To remove the main logic board:

1. Remove the rear cover.
2. Discharge the CRT. Remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

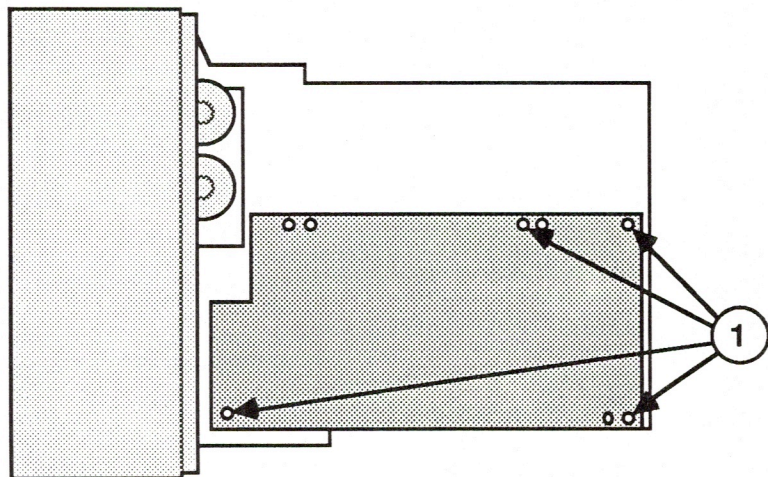


FIGURE 3

4. Remove the four screws that fasten the logic board to the metal chassis frame (Figure 3, #1).

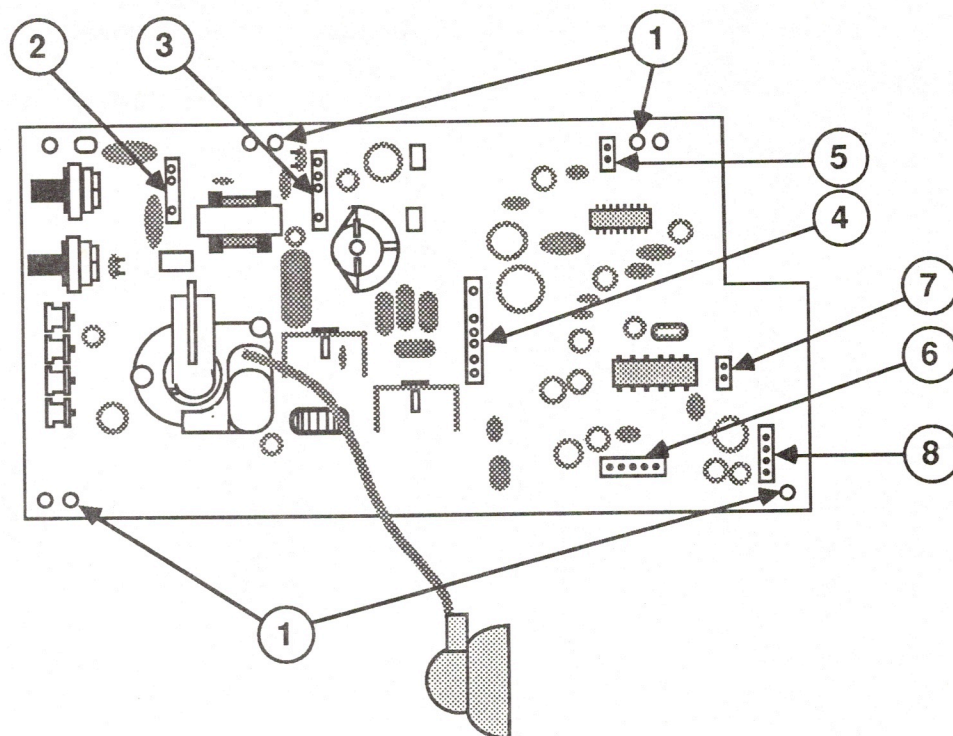


FIGURE 4

5. Look at the inside of the logic board and take off all the connectors. The seven connectors are:

- D-7, the large three-pin connector (Figure 4, #2)
- D-8, the large four-pin connector (Figure 4, #3)
- D-6, the large six-pin connector (Figure 4, #4)
- D-9, the two-pin connector (Figure 4, #5)
- D-2, the five-pin connector (Figure 4, #6)
- D-5, the two-pin connector (Figure 4, #7)
- D-4, the four-pin connector (Figure 4, #8)

Note: The last four connectors are tightly fitted and difficult to reach, so pull the logic board away from the metal chassis before you try to remove them.

6. Remove the anode wire from the plastic cable clamp under the CRT yoke.
7. Lift the main logic board from the metal chassis.

Replace

To replace the main logic board:

1. Pass the anode wire through the flyback arch on the chassis.

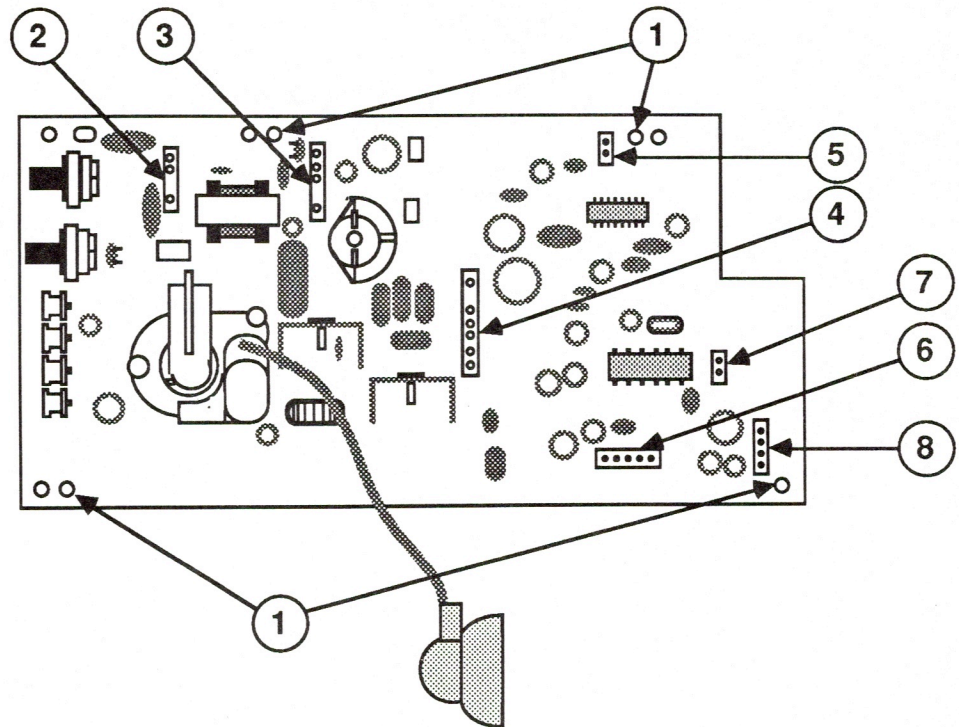


FIGURE 5

2. Starting from the end closest to the CRT, hook the connectors back to the main logic board.
 - D-4, the four-pin connector from the contrast board (Figure 5, #8)
 - D-2, the five-pin connector from the video board "C" (Figure 5, #6)
 - D-5, the two-pin connector from the interface connector (Figure 5, #7)
 - D-9, the two-pin connector from the LED board (Figure 5, #5)
 - D-6, the six-pin connector from the power supply (Figure 5, #6)

- D-8, the four-pin connector from the CRT yoke (Figure 5, #3)
 - D-7, the three-pin connector from the video board "C" (Figure 5, #2)
3. Place the logic board against the metal chassis and align the screw holes. Replace the four screws that hold the main logic board in place (Figure 5, #1).
 4. Route the anode wire through the cable clamp on the bottom of the chassis. Reconnect the anode cap, making sure that both metal clips are hooked in correctly.
 5. Place all loose wires in their plastic cable clamps.
 6. Replace the rear cover.

□ POWER SUPPLY

Materials Required

Medium Phillips screwdriver

Remove

To remove the power supply:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

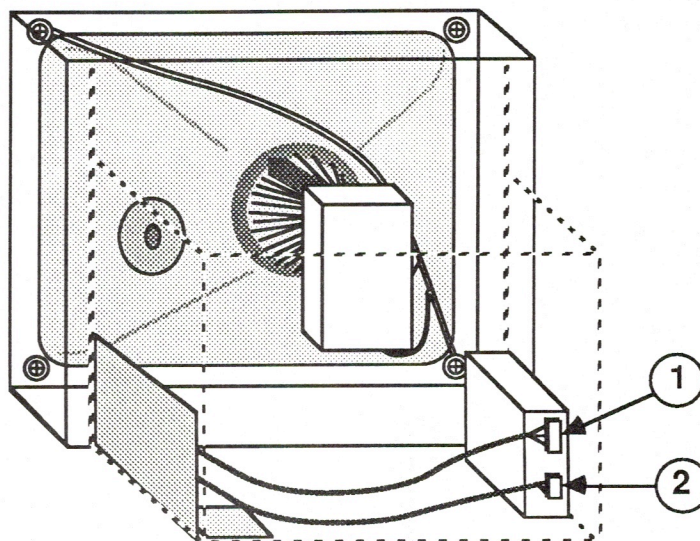


FIGURE 6

4. Unplug the six-pin connector from the top rear of the power supply (Figure 6, #1) and the three-pin connector below the six-pin connector (Figure 6, #2).

Note: It may be easier to remove the lower connector if you lift the chassis with one hand and reach the power supply from underneath with the other hand.

5. Release the CRT ground wire from the plastic cable clamp on the side of the power supply.

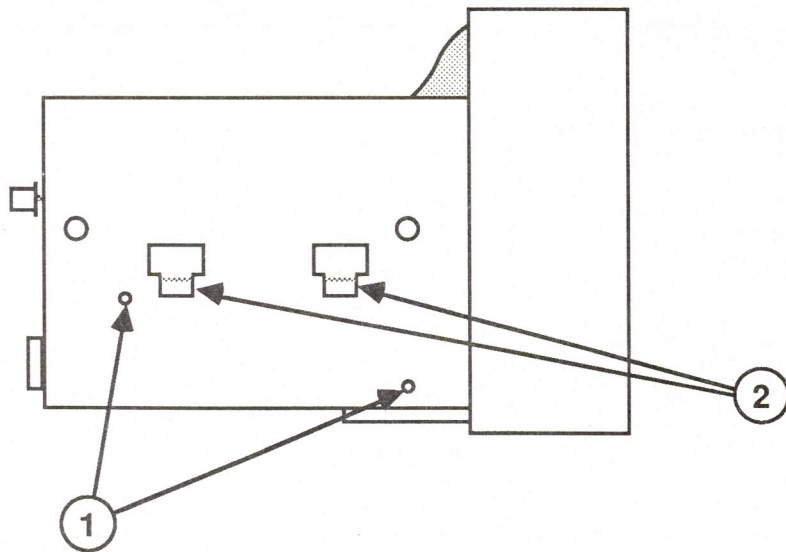


FIGURE 7

6. Unscrew the two screws on the outside of the chassis that hold the power supply in place (Figure 7, #1).
7. Lift the power supply up until the tabs on the side of the power supply (Figure 7, #2) are free of the corresponding chassis holes. Take the power supply out of the monitor and set it aside.

Replace

To replace the power supply:

1. Set the power supply inside the chassis, but don't yet insert the tabs. Reconnect the six-pin connector from the logic board (Figure 6, #1) and the three-pin connector from the power switch (Figure 6, #2) to their connectors on the rear of the power supply.
2. Slide the tabs on the side of the power supply into the holes in the side of the chassis (Figure 7, #2).
3. Replace the two screws that hold the power supply in place. The screw holes in the chassis are indicated by etched arrows (Figure 7, #1).
4. Replace all loose wires in the plastic cable clamps.
5. Replace the back cover.

□ FUSE

Materials Required

Plastic adjustment tool

Remove

To remove the fuses on the power supply:

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the power supply.
4. Remove the two screws on the sides of the power supply housing (Figure 8, #1) and the screw in the indentation on the bottom (Figure 8, #2).
5. Slide the power supply board out of the metal casing and locate the fuse on the upper left corner of the board (Figure 8, #3).
6. If the wire inside the fuse is broken, remove the fuse. Insert a plastic adjustment tool or small plastic screwdriver under one metal end, and gently pry up until you can pull the fuse out with your fingers.

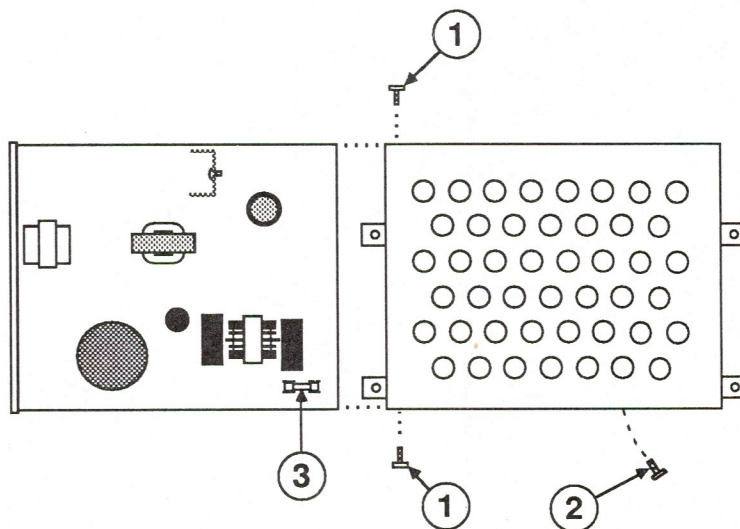


FIGURE 8

Replace

To replace the fuse:

1. Be sure you have the correct fuse (250 v, 2 A).
2. Gently press the fuse into the clamp.
3. Slide the power supply board back into its metal casing.

IMPORTANT: Make sure the power supply board slides into the middle slot on the side of the casing (Figure 9, #1). The board should not touch the bottom of the casing.

4. Replace the two screws on the side of the housing (Figure 8, #1) and the screw in the indentation on the bottom of the housing (Figure 8, #2).
5. Replace the power supply.
6. Replace the rear cover.

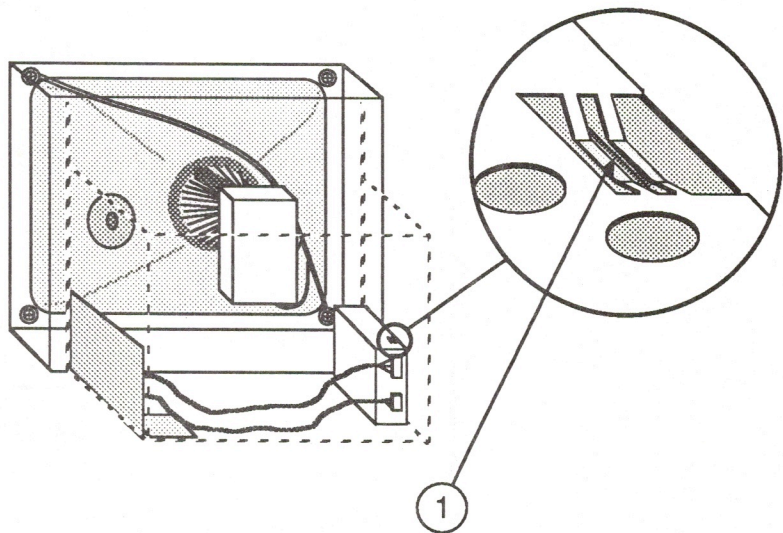


FIGURE 9

❑ CONTRAST CONTROL BOARD

Materials Required

Medium Phillips screwdriver

Remove

To remove the contrast control board:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

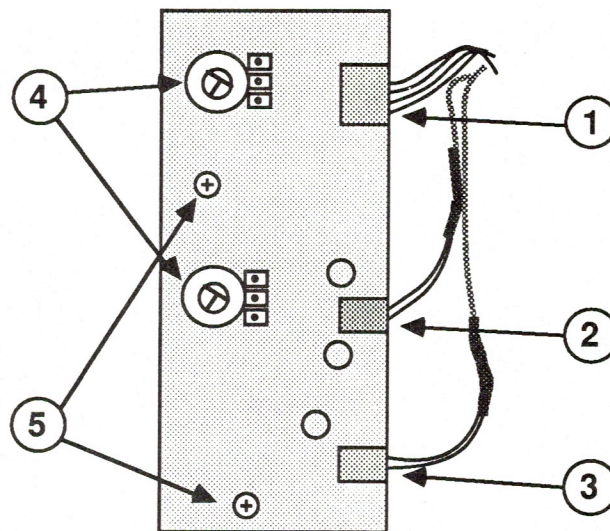


FIGURE 10

4. Remove the wires from the cable clamps. Disconnect the upper (Figure 10, #1), middle (Figure 10, #2), and lower connectors (Figure 10, #3) on the contrast control board.
5. Pull the two knobs off of the board (Figure 10, #4).
6. Remove the two screws holding the board in place (Figure 10, #5).
7. Set the board aside.

Replace

To replace the contrast control board:

1. Position the contrast control board against the chassis so that the two screw holes in the board line up with the corresponding holes in the chassis. Replace the two screws (Figure 10, #5).
2. The contrast control knob stems are keyed so that the knobs will fit in only one position. Look at the inside of the knobs and align them with the knob stems. Slide the knobs onto the stems (Figure 10, #4).
3. Reconnect the four-pin connector from the logic board (Figure 10, #1), the two-pin connector from the video board "C" (Figure 10, #2), and the two-pin connector from the interface connector (Figure 10, #3).
4. Replace the rear cover.

□ VIDEO BOARD "C"

Materials Required

Medium Phillips screwdriver

Remove

To remove the video board "C" and its cables:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

Note: The video board "C" is enclosed in a metal box. When replacing the video board "C," **keep the back cover of the metal box** and send the rest of the module, including the cables, back to Apple.

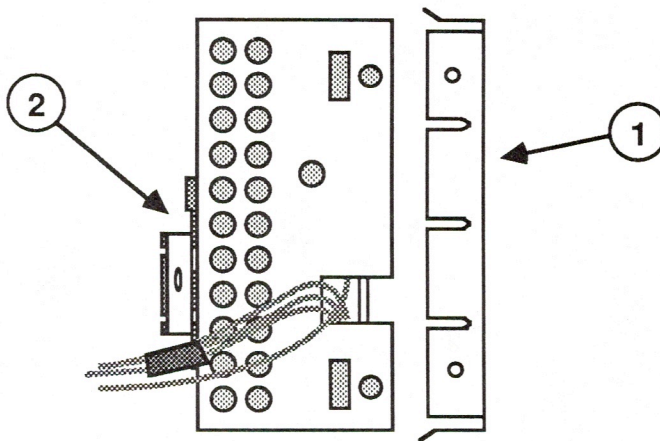


FIGURE 11

4. Pull off and set aside the back of the metal box that holds the video board "C" (Figure 11, #1).

5. Remove the cables from the plastic cable clamps. Disconnect the following connectors from the logic board:

- D2, coming from the right side of the video board "C" (Figure 12, #1).
- D7, coming from the left side of the video board "C" (Figure 12, #3).

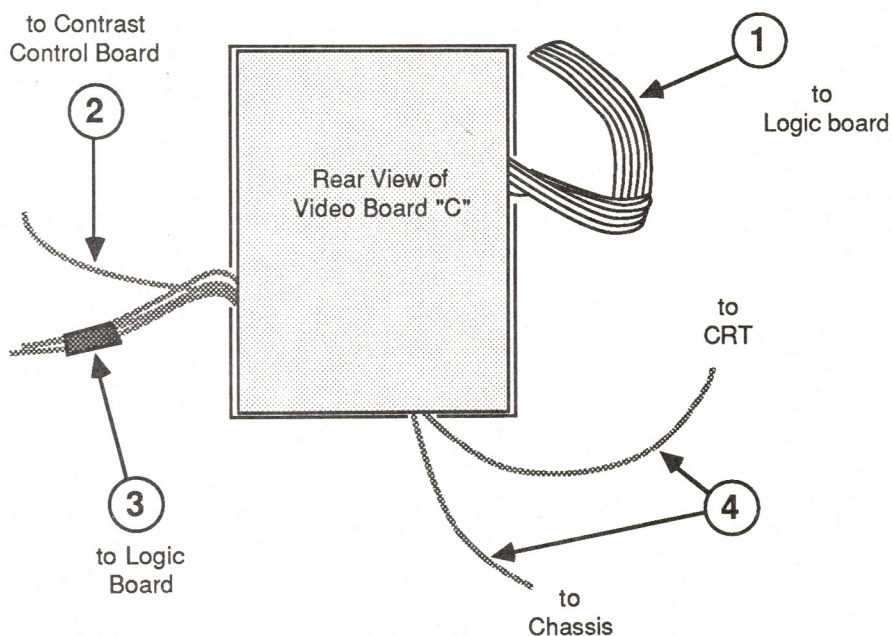


FIGURE 12

6. Disconnect the cable at location V-5 on the contrast control board (Figure 12, #2).
7. Disconnect the two black cables from the bottom of the video board "C" at their midpoint connectors (Figure 12, #4).
8. Loosen the clamp that holds the video board "C" to the CRT neck by loosening the screw partway (Figure 11, #2).
9. Pull the video board "C" off the CRT neck.

Replace

To replace the video board "C":

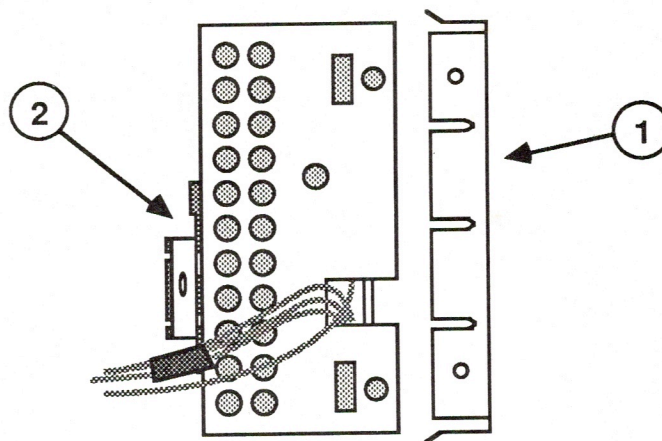


FIGURE 13

1. Replace the back cover (Figure 13, #1) on the video board "C."
2. Slide the video board "C" onto the CRT neck. Tighten the screw (Figure 13, #2) on the ring clamp just enough to keep the assembly from slipping.

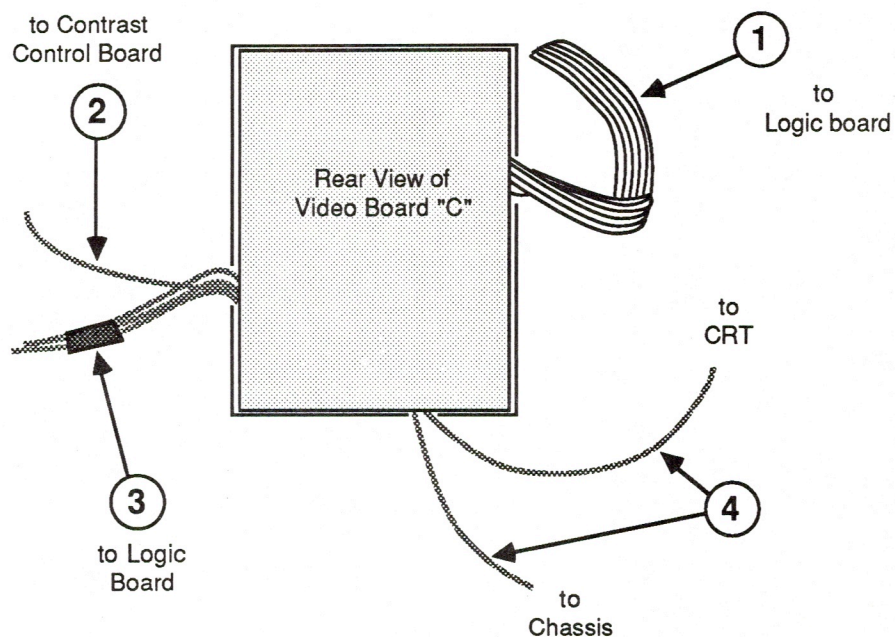


FIGURE 14

3. Reconnect the two black wires from the bottom of the video board "C" at their midpoint connectors (Figure 14, #4). The short wire goes to the chassis and the long wire goes to the CRT.
4. Reconnect the following connectors to the logic board:
 - D-2, from the left side of the logic board (Figure 14, #3).
 - D-7, from the right side of the logic board (Figure 14, #1).
5. Plug the two-pin connector (Figure 14, #2) into the contrast control board at location V-5.
6. Replace all loose cables in the plastic cable clamps.
7. Replace the rear cover.

□ CHASSIS ASSEMBLY

Materials Required

Long-handled medium Phillips screwdriver

Remove

To remove the chassis assembly:

1. Remove the rear cover.
2. Discharge the CRT. Disconnect the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the video board "C."

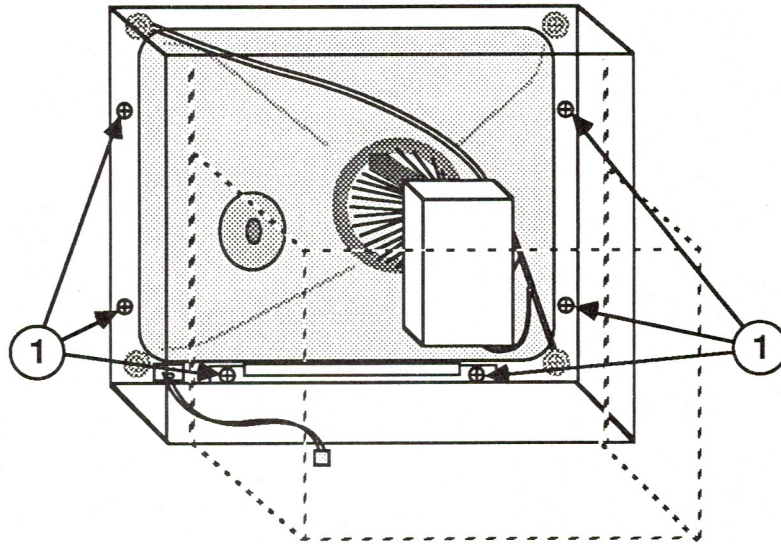


FIGURE 15

5. Remove the two-pin connector at location D-9 on the logic board.
6. Remove the six screws holding the chassis in place (Figure 15, #1).
7. Pull the chassis off the bezel.

Replace

To replace the chassis:

1. If you have removed the power supply and the logic board, replace them on the metal chassis frame.
2. Slide the chassis into the front bezel. Make sure the front of the chassis slides all the way inside the bezel at top, sides, and bottom.
3. Replace the six chassis screws (Figure 15, #1).

Note: The two screws on the bottom of the chassis have small alignment holes next to them. Make sure the corresponding plastic bumps on the bezel are aligned with these holes before you tighten the screws.

4. Replace the video board "C."
5. Replace the anode cap.
6. Replace the rear cover.

□ CATHODE RAY TUBE (CRT)

Materials Required

Long-handled medium Phillips screwdriver

Remove

To remove the CRT:

1. Remove the rear cover.
2. Discharge the CRT. Disconnect the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the video board "C."
5. Remove the connector at location D-9 on the logic board.
6. Remove the chassis assembly.

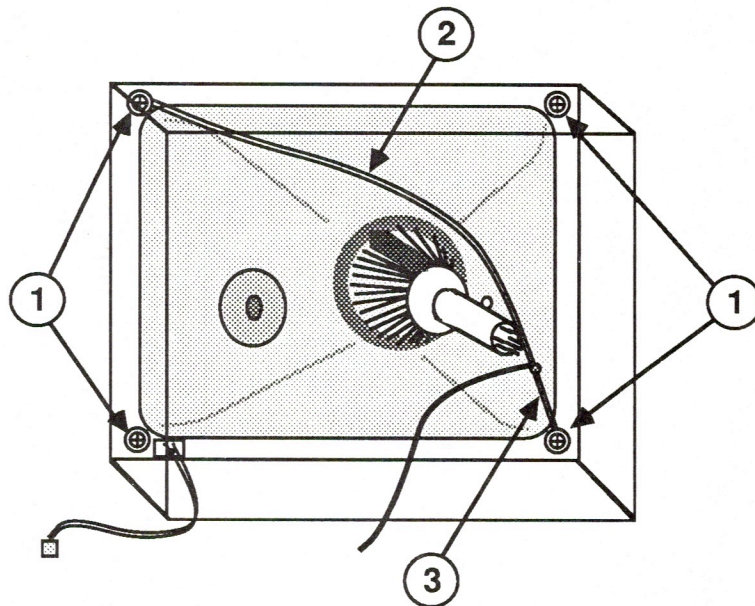


FIGURE 16

7. Remove the four mounting screws from the corners of the CRT (Figure 16, #1).
8. Carefully grasp the sides of the CRT (not the neck), and lift the CRT out of the bezel.
9. Remove the grounding strap (Figure 16, #2) and the spring (Figure 16, #3). Save them to use on your replacement CRT.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode Ray Tube" in Section 1, Basics.*

Replace

To replace the CRT:

1. Place the bezel face down on a clean, soft surface.
2. Loop the grounding strap (Figure 16, #2) over the top left screw bracket, and attach the spring (Figure 16, #3) to the bottom right screw bracket on the CRT.
3. Carefully set the CRT inside the bezel.
4. Replace the four mounting screws in the corners (Figure 16, #1). The washers go on the corners that have the attached grounding strap and spring.
5. Replace the chassis assembly.
6. Replace the connector at location D-9 on the logic board. Replace the cable in the plastic cable clamps.
7. Replace the video board "C."
8. Replace the anode cap.
9. Replace the rear cover.

□ LED CABLE ASSEMBLY

Materials Required

Long-handled medium Phillips screwdriver (magnetic)
Needlenose pliers

Remove

To remove the LED cable assembly:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Disconnect the connector at location D-9 on the logic board. Remove the cable from the cable clamps.
5. Place the monitor face down on the grounded workbench pad.

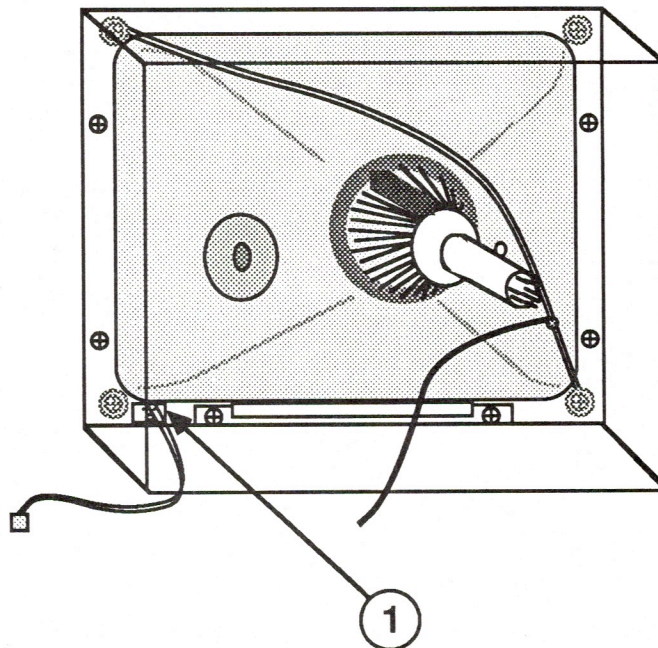


FIGURE 17

6. Remove the screw that holds the LED board in the lower left corner of the bezel (Figure 17, #1).
7. Lift the LED assembly free.

Replace

To replace the LED cable assembly:

1. Place the monitor face down. Holding the LED cable, lower the LED board through the corner space between the metal chassis and the CRT.
2. Replace the screw that holds the LED board in place on its plastic mounting. Be sure to line up the plastic alignment bump with the corresponding hole in the LED board.
3. Replace the connector at location D-9 on the logic board. Replace the cable in the plastic cable clamps.
4. Replace the rear cover.

□ POWER SWITCH

Materials Required

Medium Phillips screwdriver
Soldering tools

Remove

To remove the power switch:

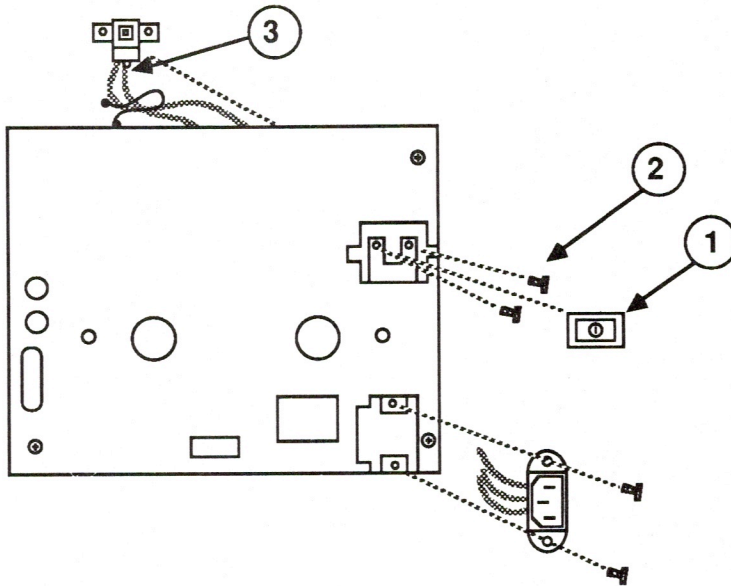


FIGURE 18

1. Pull the plastic knob off the power switch stem (Figure 18, #1).
2. Remove from the metal bracket the two screws that hold the switch (Figure 18, #2) .
3. Remove the two wires (Figure 18, #3) from the plastic cable clamp and desolder the wires from the switch.

Replace

To replace the power switch:

1. Solder the two wires to the switch (Figure 18, #3).
2. Replace the plastic cable clamp. Replace the switch in its metal bracket, lining up the screw holes.
3. Replace the two screws (Figure 18, #2).
4. Push the button on the switch stem (Figure 18, #1).

□ A/C INLET

Materials Required

Medium Phillips screwdriver
Soldering tools

Remove

To remove the A/C inlet:

1. Remove the two screws holding the inlet in place.
(Figure 19, #1).

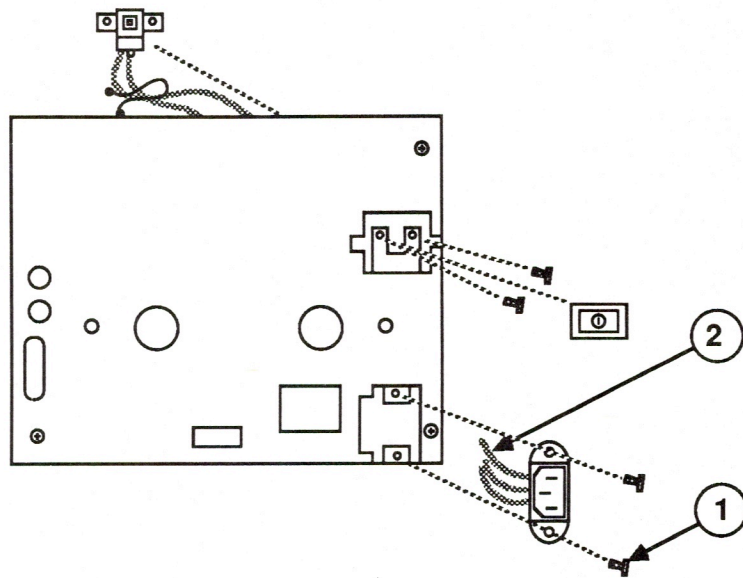


FIGURE 19

2. Remove the wires and the ferrite bead from the plastic cable clamps.
3. Desolder the three wires from the inlet (Figure 19, #2). Note where the wires go on the inlet so that you can remember where to resolder them later. Save the capacitors to reuse.

Replace

To replace the A/C inlet:

1. Make the wires to the inlet (Figure 19, #2) and the capacitors mechanically secure by twisting the wires together, then solder them.
2. Replace the wires and ferrite bead in the plastic cable clamps.
3. Line up the screw holes on the inlet with the bracket, and replace the two screws (Figure 19, #1).

High-Res Monochrome Monitor

Section 3 – Adjustments

□ CONTENTS

3.2	Introduction
3.3	Safety Instructions
3.4	Setup
3.4	Materials Required
3.4	Running the Test
3.5	Procedure
3.5	Introduction
3.6	Subbrightness (Cutoff)
3.6	Horizontal Size (Width)
3.7	Vertical Size (Height)
3.7	Focus

❑ INTRODUCTION

After you replace any module in the system you are working on, you should check the text and graphics production of the CRT. Use any text and graphics software program for the evaluation.

Do Not Adjust the Yoke

All yoke adjustments have been set by the manufacturer. Do not attempt to make any tilt, ring, or geometric adjustments on the High-Res Monochrome Monitor. If the customer's monitor has adjustment problems that the following procedures do not correct, isolate the faulty module (see Troubleshooting) and return it to Apple for repair.

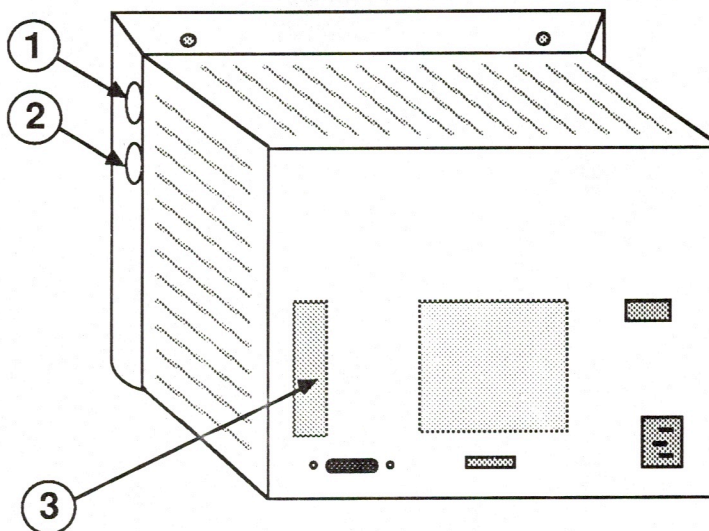


FIGURE 1

Location of Controls

The brightness control (Figure 1, #1) and the contrast control (Figure 1, #2) are located on the side of the monitor for access by the customer. All other adjustment controls are located under a rear panel for dealer access.

- Focus (Figure 2, #1)
- Subbrightness or cutoff (Figure 2, #2)
- Vertical size or height (Figure 2, #3)
- Horizontal size or width (Figure 2, #6)

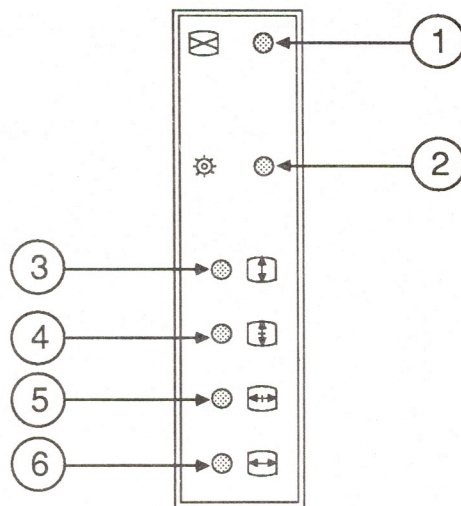


FIGURE 2

The horizontal hold (Figure 2, #4) and vertical hold (Figure 2, #5) adjustments are set at the factory and normally do not need adjusting. Only adjust these controls when symptoms described in the Diagnostics section warrant it.

□ SAFETY INSTRUCTIONS

1. Use only a three-pronged, grounded electrical outlet installed by a qualified electrician, and **do not under any circumstances use an adapter plug.**
2. Do not attempt to make any adjustments on the monitor other than those explained in this section, and do those with extreme caution.
3. Read and follow the "Safety Precautions" in the Basics section.

□ SETUP

Introduction

The monitor test section of the diagnostics contains test patterns to help you adjust the monitor. It **does not** test if the monitor is functioning correctly, nor will it diagnose monitor problems. To diagnose monitor problems, read the Troubleshooting section.

Materials Required

Plastic flatblade screwdriver (tweaker)
MacTest™II diagnostics diskette

Running the Monitor Test

The monitor test is part of the diagnostic. To run the monitor test:

1. Insert the *MacTest II* disk in the right-side drive on the Macintosh II, and turn on the power.
2. When the desktop appears on the screen, go to the Apple menu and open the Control Panel.
3. Click on the monitor icon to select the monitor test.
4. In the box called **Characteristics of Monitor**, click on **Black & White/Gray**.

Note: If you select the color test for a black-and-white monitor, the gray bars will be incorrect and the test results invalid.

5. In the box called **Colors**, choose **16 or the highest number available**.
6. Close the Control Panel window. When the desktop reappears, click on the *MacTest II* icon to start the test.
7. The Video RAM Test runs automatically as soon as you start the diagnostic. You will see lines and bars flash across the screen until the crosshatch pattern appears. The crosshatch pattern is the first of the monitor test patterns.

Note: If the Video RAM Test fails, replace the video interface board and run the diagnostic again to get to the monitor section of the test.

□ PROCEDURE

Introduction

For all of the following adjustments, set the contrast knob (Figure 3, #2) on maximum and the brightness knob (Figure 3, #1) on the center click position.

To find the center click position on the brightness knob, turn the knob up as far as it will go, and then turn the knob down as far as it will go. The place in the middle where the knob hesitates is the center click.

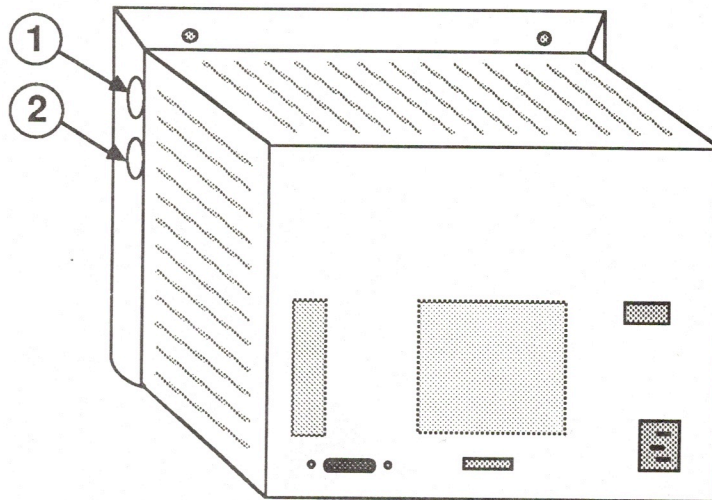


FIGURE 3

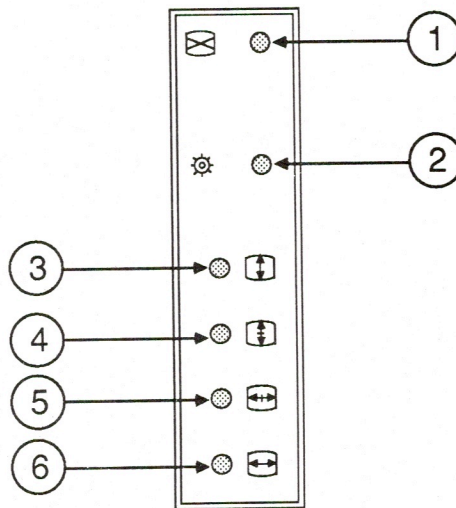


FIGURE 4

Subbrightness (Cutoff)

1. Select the **Gray Bar** pattern from the monitor tests on the *MacTest II* diagnostics.
2. Insert the plastic screwdriver in the subbrightness (cutoff) control (Figure 4, #2), and twist it until the second bar from the left is black at its center.

Horizontal Size (Width)

To make the horizontal adjustment:

1. Select the **Cross Hatch** pattern from the monitor tests on the *MacTest II* diskette.
2. Insert the plastic screwdriver in the horizontal size control (Figure 4, #6) and twist it until the raster is 213.5 mm wide.

IMPORTANT: Always adjust the horizontal size before you adjust the vertical size. The horizontal adjustment can affect the height of the raster.

Vertical Size (Height)

After you have adjusted the horizontal size, you can adjust the vertical size:

1. Select the **Cross Hatch** pattern from the monitor tests on the *MacTest II* diskette.
2. Insert the plastic screwdriver in the vertical size control (Figure 4, #3) and twist it until the raster is 160 mm high.

Focus

1. Select the **Cross Hatch** pattern from the monitor tests on the *MacTest II* diagnostics.
2. Insert the plastic screwdriver (tweaker) in the focus control (Figure 4, #1), and adjust the focus for the best clarity at the center of the screen.

High-Res Monochrome Monitor

Section 4 – Troubleshooting

□ CONTENTS

- 4.2 Introduction
- 4.2 Symptom Chart

□ INTRODUCTION

This section contains a symptom chart for the High-Res Monochrome Monitor showing common problems and their solutions. Find the best description of the symptom(s) your defective monitor is displaying; then try the recommended actions in the order listed.

If the first corrective action does not solve the problem, put back the original module or part before you try the next action.

□ SYMPTOM CHART

*No power
(LED does not light)*

1. Check the internal power connectors.
2. Check fuse; replace if blown. If it blows again, go to the next step.
3. Replace power supply.
4. Replace power switch.

No raster

1. Adjust the brightness and contrast knobs.
2. Adjust the sub-brightness (cut-off) control.
3. Make sure the logic board is connected to the power supply.
4. Check fuse; replace if blown. If it blows again, go to the next step.
5. Replace the power supply.
6. Replace the logic board.
7. Replace the power switch assembly.
8. Replace the video board "C."
9. Replace the contrast control board.
10. Replace the CRT.

*One horizontal
line appears
on screen*

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

*One vertical
raster line
appears*

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

*Raster not
rectangular*

1. Ensure that all connectors are plugged in correctly.
2. Replace the logic board.
3. Replace the power supply.
4. Replace the CRT assembly.

*Raster stretched or
compressed on
side of screen*

- Replace the logic board.

*Raster stretched or
compressed at top
of screen*

- Replace the logic board.

*Picture breaks in
diagonal lines*

1. Adjust horizontal hold.
2. Replace the logic board.
3. Replace the power supply.

*Raster size small,
picture abnormally
bright*

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

*Picture rolls
vertically*

1. Adjust vertical hold.
2. Check the connector on the I/O connector board.
3. Replace the logic board.

*Raster not
centered*

1. Adjust the horizontal hold.
2. Replace the logic board.
3. Replace the CRT.

*Brightness cannot
be adjusted*

1. Replace the contrast control board.
2. Replace the logic board.
3. Replace video board "C."
4. Replace the CRT.

Picture jitters

1. Confirm that the grounding cables are attached to the chassis.
2. Confirm that the computer is grounded correctly.
3. Replace the power supply.
4. Replace the logic board.

Black spots on screen (burnt phosphor)

- Replace the CRT.

Image is too dark or too bright

1. Adjust the brightness knob.
2. Adjust the sub-brightness (cut-off) control.
3. Replace the logic board.
4. Replace video board "C."
5. Replace the CRT.

Focus cannot be adjusted

1. Replace the logic board.
2. Replace the video board.
3. Replace the CRT.

Flashing lines on screen

1. Confirm the contact of the video connector.
2. Replace the contrast control board.

Raster higher on one side than the other.

1. Replace the logic board.
2. Replace the CRT.

High-Res Monochrome Monitor

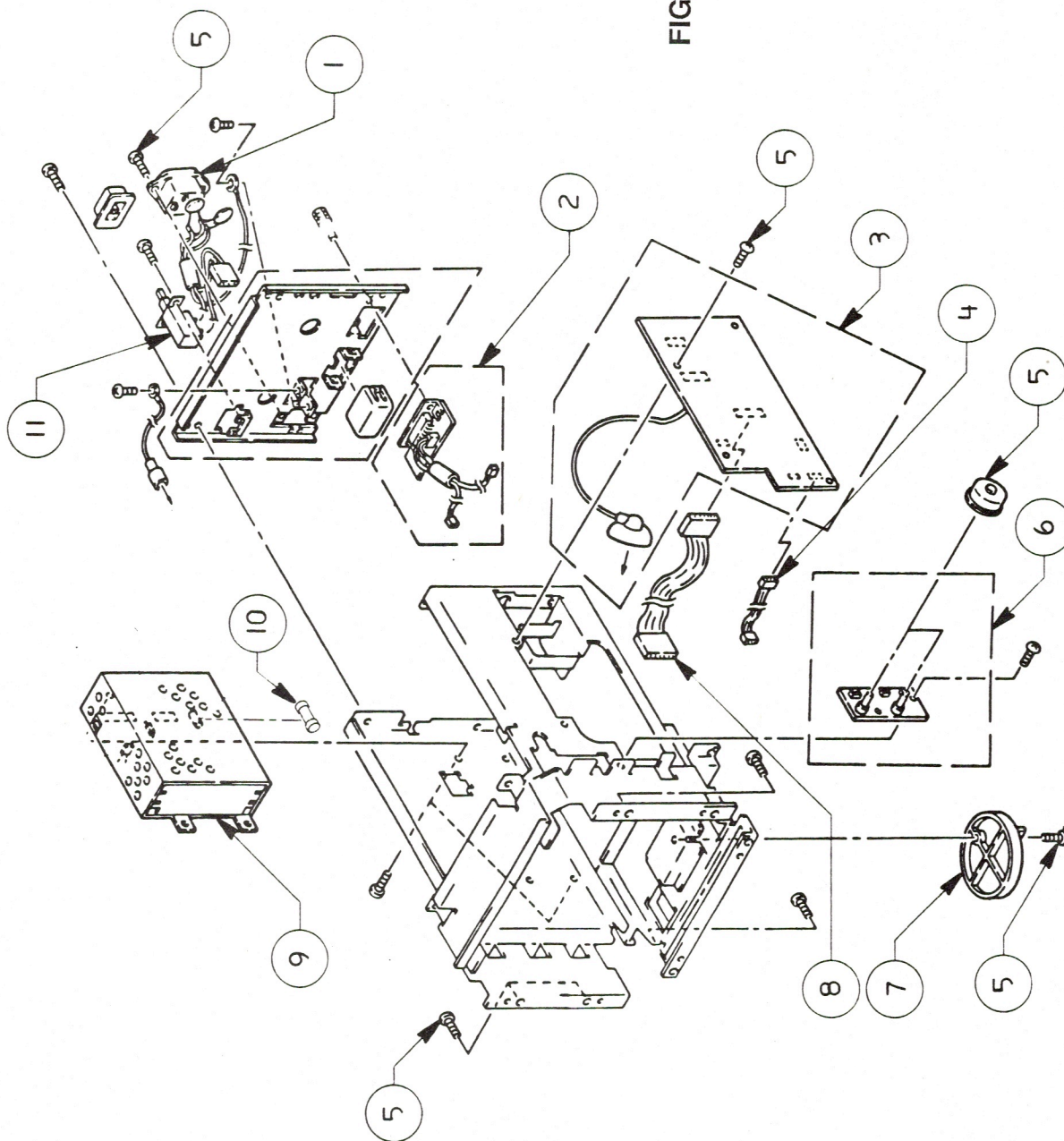
Illustrated Parts List

❑ CONTENTS

- IPL.3 Internal Assembly (Figure 1)
- IPL.5 CRT Case Assembly (Figure 2)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple High-Res Monochrome Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

FIGURE 1



□ INTERNAL ASSEMBLY (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	932-0003	AC Inlet
2	933-0014	I/O Connector Board
3	661-0396	Main Logic Board (D)
4	590-0442	Cable, Logic Board to Control Panel
5	956-0007	Screw/Knob Set
6	905-0004	Contrast Control Board
7	949-0118	Stand Attachment, Plastic Bottom
8	590-0441	Cable, Logic Board to Power Supply
9	661-0395	Power Supply
10	740-0305	Fuse, 250 v, 2 amp
11	937-0025	On/Off Switch

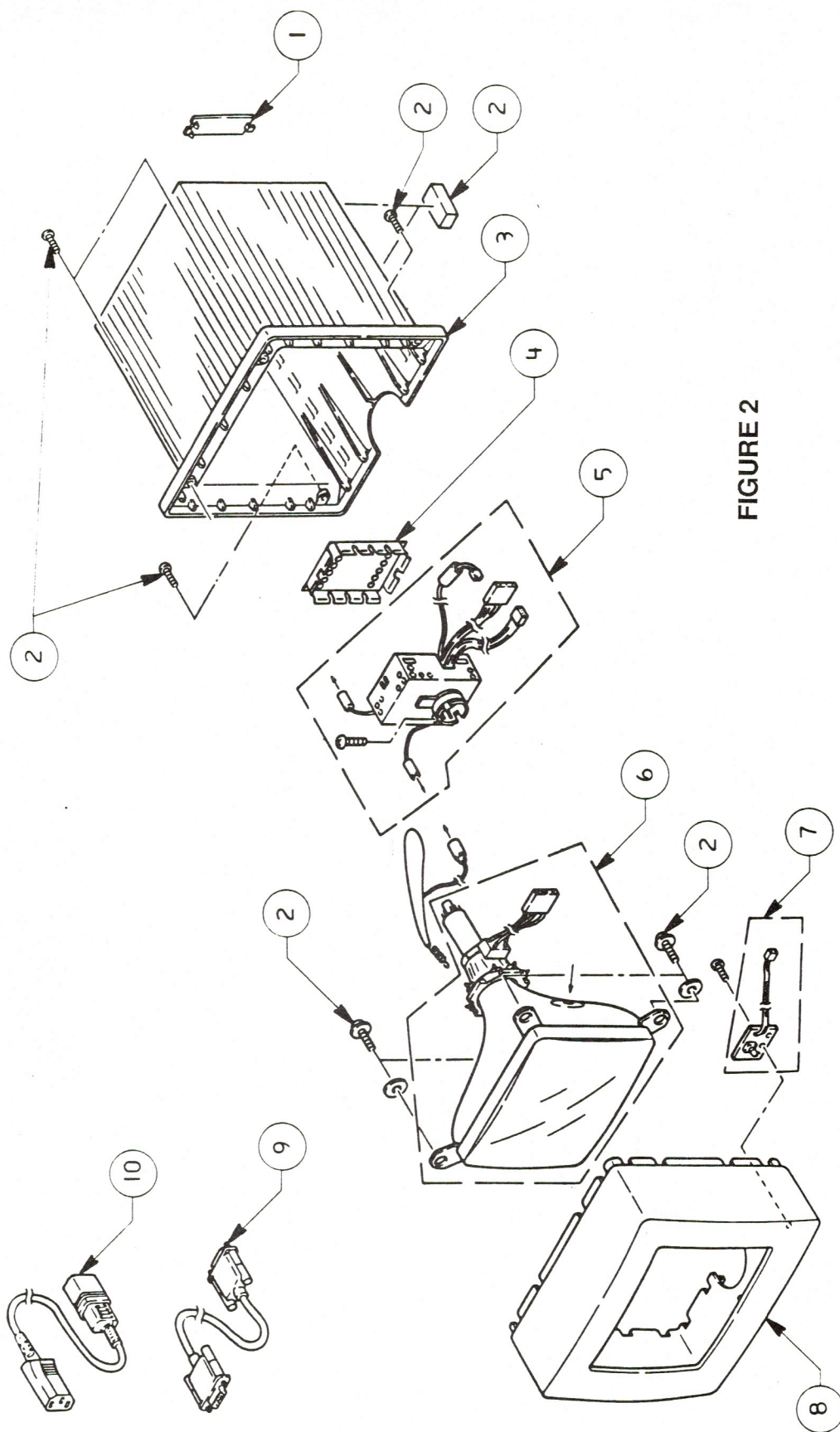


FIGURE 2

□ CRT CASE ASSEMBLY (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	949-0119	Adjustment Panel Cover
2	956-0007	Screw Knob Set
3	949-0117	Rear Cover, Plastic
4	948-0031	Video Board "C" Case Cover
5	981-0007	Video Board "C" with Cable
6	076-0246	CRT Assembly
7	590-0440	LED Cable Assembly
8	949-0116	Bezel, Plastic Case
9	590-0161	Cable, CPU to Monitor
10	590-0370	Cable, External Power

